

CALIFORNIA  
ENERGY  
COMMISSION

# CALIFORNIA STRATEGIC FUELS RESERVE

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## GLOSSARY

ANS	Alaska North Slope, term used to designate crude oil of that region
ARB	Air Resources Board
CAA	Clean Air Act of 1977
CAAA	Clean Air Act Amendments of 1990
CAAA Title V	Section of the CAAA requiring Operating Permits, promulgated in 1992
CARB	California Air Resources Board
CARBOB	California Reformulated Gasoline Base Oxygenated Blendstock
CEC	California Energy Commission
CMAI	Chemical Markets Associates, Inc.
cpg	Cents per Gallon
CSLC	California State Lands Commission
EIA	Energy Information Agency
EPCA	Energy Policy and Conservation Act of 1976 as amended
ETBE	Ethyl Tertiary Butyl Ether, an oxygenate produced from ethanol and isobutylene
FCC	Fluidic Catalytic Cracker, primary gasoline producing unit in a refinery
IEA	International Energy Agency
Jobber	Independent distributor of petroleum products
MB	Thousand barrels
MOTERP	Marine Oil Terminal Engineering Regulations Project of the CSLC
MTBE	Methyl Tertiary Butyl Ether
NHOR	Northeast Heating Oil Reserve
NYMEX	New York Mercantile Exchange
OPA 90	Oil spill Prevention Act of 1990
OPIS	Oil Price Information Service
p.a.	Per annum
PADD	Petroleum Administration for Defense District. PADD V includes Hawaii, Alaska, Washington, Oregon, California, Arizona and Nevada
PoLA	Port of Los Angeles
PoLB	Port of Long Beach
RFG	Reformulated Gasoline meeting the requirements of the CAAA
RVP	Reid Vapor Pressure, a measurement of the volatility of gasoline
SARA	Superfund Amendments and Reauthorization Act of 1986
SCQAMD	South Coast Air Quality Management District
SFR	Strategic Fuels Reserve

TBD	Thousand Barrels per Day
TEU	Twenty-foot Equivalent Unit, standard used for cargo containers
TPY	Ton Per Year, usually referring to US short tons of 2000 lbs
USGC	US Gulf Coast
VLCC	Very Large Crude Carrier, a tanker capable of carrying 1.5 – 2 million barrels
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound(s), and emissions thereof

## CHARTER

In 1999, following a series of refinery outages that caused significant price spikes in the California fuels markets, the Attorney General's office created a taskforce to investigate causes and recommend solutions to prevent recurrence. The efforts of this taskforce resulted in Assembly Bill 2076, which called for the California Energy Commission:

“..to examine the feasibility of operating a strategic fuel reserve and to examine and recommend an appropriate level of reserves. If the commission finds that it would be feasible to operate such a reserve, the bill would require the commission to report this finding to the Legislature and request specific statutory authority and funding for establishment of a reserve.”

The bill also provided general directions for the work to be performed

(a) By January 31, 2002, the commission shall examine the feasibility, including possible costs and benefits to consumers and impacts on fuel prices for the general public, of operating a strategic fuel reserve to insulate California consumers and businesses from substantial short-term price increases arising from refinery outages and other similar supply interruptions. In evaluating the potential operation of a strategic fuel reserve, the commission shall consult with other state agencies, including, but not limited to, the State Air Resources Board.

(b) The commission shall examine and recommend an appropriate level of reserves of fuel, but in no event may the reserve be less than the amount of refined fuel that the commission estimates could be produced by the largest California refiner over a two week period. In making this examination and recommendation, the commission shall take into account all of the following:

(1) Inventories of California-quality fuels or fuel components reasonably available to the California market.

(2) Current and historic levels of inventory of fuels.

(3) The availability and cost of storage of fuels.

(4) The potential for future supply interruptions, price spikes, and the costs thereof to California consumers and businesses.

(c) The commission shall evaluate a mechanism to release fuel from the reserve that permits any customer to contract at any time for the delivery of fuel from the reserve in exchange for an equal amount of fuel that meets California specifications and is produced from a source outside of California that the customer agrees to deliver back to the reserve within a time period to be established by the commission, but not longer than six weeks.

(d) The commission shall evaluate reserve storage space from existing facilities.

(e) The commission shall evaluate a reserve operated by an independent operator that specializes in purchasing and storing fuel, and is selected through competitive bidding.

This Study was performed within the specific framework of the Legislation, to answer as a minimum the questions asked, by the stated deadline. In addition, in cooperation with the consultant retained by the Commission for this study, Stillwater Associates of Irvine, CA, the Commission deemed it appropriate to evaluate other factors that contribute significantly to the volatility of California's fuel markets, such as breakdowns in market mechanisms for gasoline, and the inadequacy of the logistics infrastructure serving the fuels market.

## APPROACH

The approach taken by Stillwater and the CEC for this study is to:

(i) Conduct a survey amongst industry stakeholders, such as refiners, traders, logistic survey providers, and other concerned parties such as industry associations representing independent gasoline marketers, port authorities, and market intelligence providers. The purpose of the survey was not only to gather relevant information and data such as supply and demand factors, but also to gain a full understanding of market mechanisms and barriers to entry that contribute to the price spikes that a reserve aims to prevent.

(ii) Using the requirement of AB2076 for two week's capacity of the largest refinery as the basis, evaluate requirements for the reserve other than size, and with these, derive such factors as optimal location, infrastructure needs, and costs for several options meeting the initial requirements. Since the study did not include funding of actual engineering work, costs are treated at order of magnitude levels only.

(iii) Evaluate the effectiveness of the selected options for the reserve in terms of their anticipated capacity to mitigate price spikes in the California fuel markets due to unplanned refinery outages, using historical statistical data to predict the probability and duration of occasions when reserve volume would be drawn down. If warranted by the predicted effectiveness, adjust the design reserve volumes from the suggested two week's capacity basis and reiterate.

(iv) Using insights gathered during the survey meetings, design release mechanisms for the reserve volumes, also taking into account experience gathered with strategic reserves operated elsewhere.

(v) Develop derivative opportunities such as using a reserve to create forward liquidity in the California fuel markets.

(vi) Evaluate next steps and implementation plans, and identify potential barriers to implementation, such as delays in permitting processes.

(vii) Collect feedback from the industry in an open forum workshop, and adjust where necessary the recommended alternatives.

(viii) Present the final conclusions and recommendations to the legislature.

Initially, it was assumed that this study would be based on a supply/demand scenario for which the issue of the impending phase out of MTBE in terms of timing and impact would have been resolved. When it became clear that additional efforts would be required to provide decision tools for this critical issue, the CEC charged Stillwater Associates to conduct a parallel study specifically focused on the MTBE phase out.

Where necessary for the sake of clarity and consistency, the reports issued by Stillwater Associates for this Strategic Fuels Reserve Study and the MTBE Phase Out Study make extensive use of the same materials.

## EXECUTIVE SUMMARY

The initial phase of the study consisted of interviews and survey meetings with a total of 44 oil industry participants, including major refiners, suppliers from outside the State, traders, independent retailers, logistic service providers and other stakeholders. The primary conclusions from these meetings are that:

(i) Overall, the industry opposes the concept of a state-run reserve and fears that the existence of a reserve may be counterproductive to resolving long-term supply/demand imbalances.

(ii) If a reserve is to be created, the industry strongly prefers that it will not use already scarce existing storage, is privately operated, has clear and fair release mechanisms, and is deployed in such a way as to improve import opportunities and market liquidity.

(iii) The California gasoline market suffers from insularity caused by its unique specifications, a subsequent lack of liquidity, inability to lock in future pricing, and impediments to market entry by outside sources. These factors contribute significantly to price volatility, in addition to the supply interruptions identified as a cause of price spikes in the legislation that led to this study.

(iv) California's infrastructure for petroleum products, comprising of pipelines, terminals and dock facilities, has insufficient capacity to handle current and anticipated demand. Capacity additions are hampered by lengthy and costly permitting procedures, and by policies practiced by the ports that favor other land uses over bulk liquid storage.

Subsequent work confirmed that:

(v) The output of California's refineries has not been able to keep up with demand growth in recent years and the State has become a net importer of all categories of petroleum products. Moreover, the outlook is that permitting restraints will make it more difficult for refiners to continue to realize small gains in production capacity, which have averaged approximately 1% per year since 1995, when refineries first started to run at or near maximum sustainable operating rates.

(vi) The growing import dependency is met primarily through foreign imports, with supplies from the US Gulf coast refineries stagnating because this capacity is fully utilized serving other US markets, while Jones Act shipping capacity is unavailable and faces significant further reductions as single hull product tankers are phased out.

(vii) Not only are foreign imports of gasoline and blending components indeed constrained by lack of tank capacity in marine terminals, but in addition significant commercial barriers exist because of

lack of hedging opportunities which forces importers to incur significant risk in the volatile California markets.

(viii) Additional barriers to entry are also formed by the Unocal patents, which discourage traders or independent importers from attempting to bring finished products to the market, leaving only the California refiners capable of blending around the patent or absorbing the cost of licensing fees. The detrimental effects of the Unocal patents extend also to loss of production capacity, because refinery streams that might have been accretive to the gasoline pool are diverted to avoid patent infringement, while blending around the patent results in gasoline qualities that have sub-optimal emission performance.

(ix) The chronic shortage of gasoline in the California market will be aggravated to unprecedented levels by the proposed phase-out of MTBE by year-end 2002, in particular in the LA Basin. The prognosis is that a temporary shortfall of 5 to 10% will result, causing prices in California to rise to double that of world markets. This in turn will attract other supplies, and prices are expected to level off at premiums over world markets of 20 – 30 cents per gallon.

(x) Under this scenario, the impact of temporary supply disruptions caused by refinery outages will be significantly more pronounced, since some of the initial price elasticity has already been absorbed.

(xi) The expectation is that the import dependency and chronic undersupply will cost gasoline consumers in California between \$3 – 5 billion per year over what they would pay in a market where supplies are unrestrained. In addition, it is expected that on average, one major and several smaller supply disruptions will occur every year, resulting in a temporary price spikes that add another \$1 billion to California's collective gasoline bill. It is estimated that for the largest part, the incremental revenues from gasoline sales will flow to energy companies outside the State.

The recommendations formulated at this stage are:

(xii) The State of California is to issue a tender for the creation of 5 million barrel of versatile petroleum product storage under long-term lease agreements, 3 million of which would be in the LA basin and 2 million in the Bay Area. In both locations, this storage is to be provided with deepwater access and connections to the main product distribution pipeline systems.

(xiii) The 5 million barrels is twice the proposed volume of actual reserves, and as part of the storage lease agreements, the State will require the contract operator of this tankage to sublease half of the new capacity to interested third party market participants under short-term contracts, with the State only providing a minimal guarantee in case storage is not occupied for a certain amount of time.

(xiv) The State of California will purchase 2.5 million barrels of gasoline and gasoline blending components to form the basis for a Fuels Bank, from which qualified industry participants can withdraw

volumes against a fee, with an obligation to re-supply the borrowed volumes within an agreed time span. Potentially, some of the State's obligations to purchase power can be exchanged for purchases of fuels using hedging and exchange mechanisms to offset corresponding intrinsic energy values.

(xv) The fee for the temporary usage is to be determined in daily electronic auctions, whereby the qualified participants can bid for the privilege of the time value of the product. Minimum fees should be set such that the operational cost of maintaining the State's share of the inventories is largely covered. In times of shortage, i.e., when a refinery outage has been announced, these fees can be expected to be bid up sharply, but as a derivative, their overall impact on the cost of supply is expected to be considerably less than run ups in the price itself in times of shortage.

(xvi) In this way, not only is a reserve created that will suppress price excursions in a cost effective way, with savings to California gasoline consumer far outweighing the cost to the taxpayer, but a physical delivery point and hedging mechanism is created that will facilitate imports and significantly reduce the State's risk of import dependency for its transportation fuels.

## 1 CALIFORNIA FUELS MARKET

The California market for petroleum products is insular in nature, isolated from the main US continental markets by the Rocky Mountains to the East and from most other major fuels markets by the Pacific Ocean in the West. The geographical isolation is aggravated for gasoline and diesel by the unique fuel specifications that were mandated by the State in the past decade to protect its air quality, a process that is still continuing with the anticipated introduction of CARB Phase III reformulated gasoline specifications in the near future.

Even within the California market, a certain amount of insularity occurs. The Northern California market, with the Bay Area as its main center, and the Southern market structured around Los Angeles, are not linked by pipelines for petroleum products and behave in many ways semi-autonomously. A third production center around Bakersfield has only limited capacity for gasoline and distillates. Within the San Joaquin Valley, other insular niche markets exist such as the markets for diesel in agricultural centers. External and internal insularity are major factors when evaluating the effectiveness and optimal locations for an eventual Strategic Reserve.

In the past California exported small excess quantities of certain fuels. In recent years however, the State has become a net importer of all petroleum products including finished gasoline, blend stocks, diesel and jet fuel, and the State's shortfall is expected to increase significantly over the coming years<sup>1</sup>. The State receives limited supplies from refiners in nearby Washington, but California has to cover the bulk of its shortfall of petroleum products with imports from remote sources such as the US Gulf Coast, the Canadian East Coast, the Caribbean, Europe, Asia, and the Middle East. It is important to note that the shortfall is not only caused by demand for fuels within the State, but that the California refiners also supply markets in Nevada and parts of Arizona, including fast growing population centers such as Las Vegas and Phoenix.

The proposed phase out of MTBE, currently scheduled for year-end 2002, concurrent with the introduction of the more stringent CARB Phase III requirements, will cause a reduction in supplies by 5 to 10%. This shortfall will predominantly affect the LA Basin market and is as yet not covered. Even if available import sources were to be identified within the global refinery network, the State would lack the infrastructure to handle a diverse mixture of blending components. Under scenarios in which the State is chronically undersupplied, the volatility of fuel pricing can be expected to grow progressively worse. Below, supply and demand will be analyzed for several scenarios, in particular with regard to imbalances that will increase price volatility and hence, the value of an eventual SFR.

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<sup>1</sup> *Energy Outlook 2020*, California Energy Commission Staff Report, Docket No. 00-CEO-Vol II, August 2000

## 1.1 Current Supply

Forecasting the supply of clean petroleum fuels into California requires an analysis of its refineries and their capability for expansion, and an evaluation of import opportunities in terms of sources, logistical infrastructure and economical feasibility.

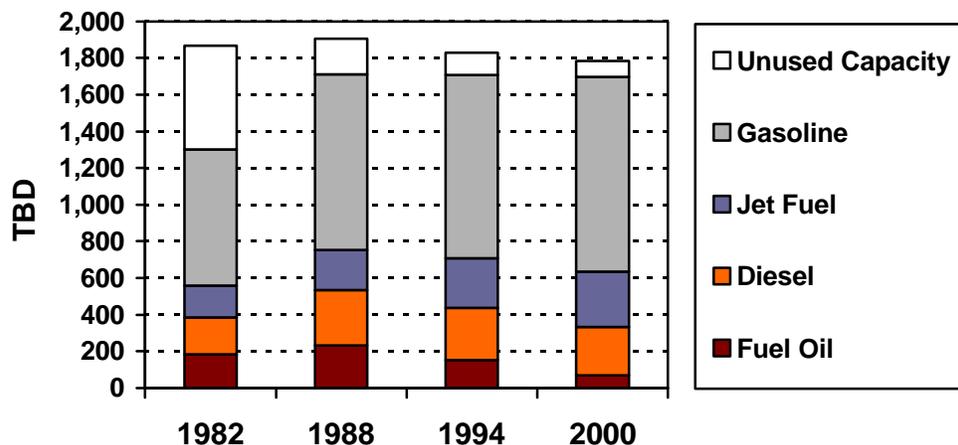
### 1.1.1 Refining Capacity in California

Historically, two factors have contributed to rationalization and concentration of refining capacity in California:

- The deregulation of the markets for petroleum products in 1981<sup>2</sup>, which accelerated the closure of many uneconomic refineries nationwide.
- The requirements of the Clean Air Act Amendments (CAAA) of 1990, which for several refineries could not be achieved economically.

The concentration of production that took place from the mid 80-ies through the mid 90-ies has not only resulted in high utilization rates of remaining capacity, but the investment programs to meet the requirements of the CAA and subsequent amendments also led to a significant increase in gasoline production of lighter components at the expense of heavy fuel oil. As a result, the remaining gasoline-producing refineries in California are highly sophisticated full conversion facilities.

Figure 1.1 – CA Refinery Capacity Utilization<sup>3</sup>



<sup>2</sup> Executive Order 12287, Providing for the Decontrol of Crude Oil and Refined Petroleum Products, Jan 28, 1981.

<sup>3</sup> Source EIA and CEC data. Stream day capacities.

Figure 1.1 shows how since the mid 90-ies, unused refining capacity in California is less than 5%, indicating that all remaining refineries in California have essentially been running at the maximum practically feasible operating rate given the average age and the mechanical complexity of the installations. It also shows that the remaining refining capacity is predominantly geared towards production of gasoline at the detriment of fuel oil output, as a result of heavy investments into cracking and coking capacity in the late 80-ies and early 90-ies.

Out of the 15 refineries currently operating in California, only 12 facilities, owned by 7 companies, are capable of producing California specification gasoline and diesel. The capacities of these refineries are summarized below in Table 1.1 below.

Table 1.1 – California Fuels Production 1995-2001<sup>4</sup>

	TBD	1995	1996	1997	1998	1999	2000	2001
<b>NORTHERN CA</b>								
CARB RFG		48.4	320.1	381.3	387.0	369.1	392.2	402.0
Oxygenated Gasoline		106.1	22.1	0.2	-	-	-	-
Other Finished Gaso		277.1	110.6	62.9	68.7	33.5	51.7	58.3
CARB Diesel		128.8	126.5	133.0	2.2	81.8	104.9	115.4
EPA Diesel		n/a	n/a	n/a	115.3	30.1	19.0	22.5
High S Diesel		19.2	15.1	4.3	2.4	7.7	8.1	5.2
Jet Fuel		97.0	111.6	111.5	102.0	84.5	94.5	101.4
<b>SOUTHERN CA</b>								
CARB RFG		405.1	464.4	493.2	399.0	584.9	548.6	552.3
Oxygenated Gasoline		3.6	-	0.8	n/a	3.9	5.5	3.1
Other Finished Gaso		126.3	71.6	61.5	65.9	52.9	52.5	40.2
CARB Diesel		122.7	125.1	127.3	1.7	56.8	69.4	74.1
EPA Diesel		n/a	n/a	n/a	139.6	102.4	76.8	81.4
High S Diesel		19.8	19.4	12.8	10.8	4.6	6.3	1.5
Jet Fuel		148.2	169.0	164.4	157.4	143.6	149.4	139.0
<b>TOTAL CA</b>								
CARB RFG		453.4	784.5	874.5	786.0	954.0	940.8	954.4
Oxygenated Gasoline		109.7	22.1	1.1	n/a	3.9	5.5	3.1
Other Finished Gaso		403.4	182.2	124.4	134.6	86.4	104.2	98.5
CARB Diesel		n/a	n/a	n/a	3.9	138.6	174.3	189.5
EPA Diesel		n/a	n/a	n/a	254.9	132.5	95.8	103.9
High S Diesel		39.1	34.4	17.0	13.3	12.3	14.4	6.8
Jet Fuel		245.2	280.6	275.9	259.3	228.1	243.9	240.4

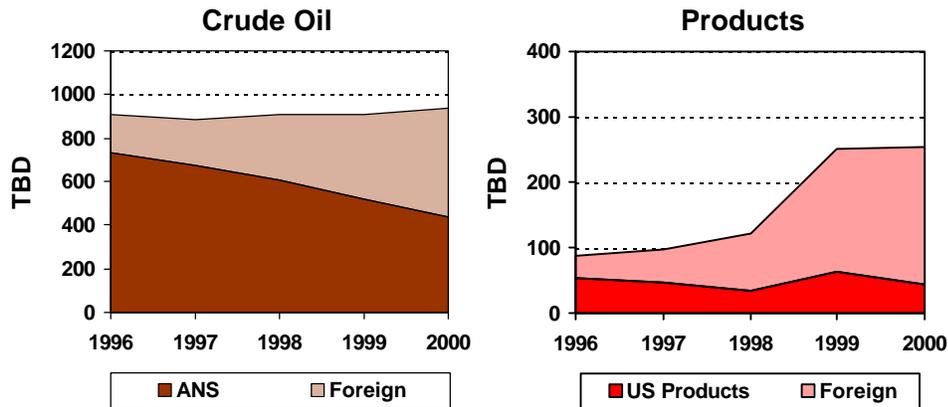
The production numbers for gasoline cited in Table 1.1 include blending components and unfinished gasoline blend stocks imported by the refineries. These imports play an increasingly important role in the refiner's abilities to meet California's fuels demand, and a detailed analysis of the imported petroleum products will be provided below.

<sup>4</sup> Data from CEC weekly reported production numbers.

### 1.1.2 Imports of Petroleum Products

In the past, California was a net exporter of petroleum, either as crude oil or as refined distillates and partially refined feedstocks. In recent years however, internal demand has grown, and even though the refineries have become more sophisticated as California crude oil production has declined, the net effect is that imports of both crude oil and refined products have grown substantially, making the State a significant net importer of foreign crude and petroleum products, as shown in Figure 1.2.

Figure 1.2 – CA Foreign Imports of Crude & Products

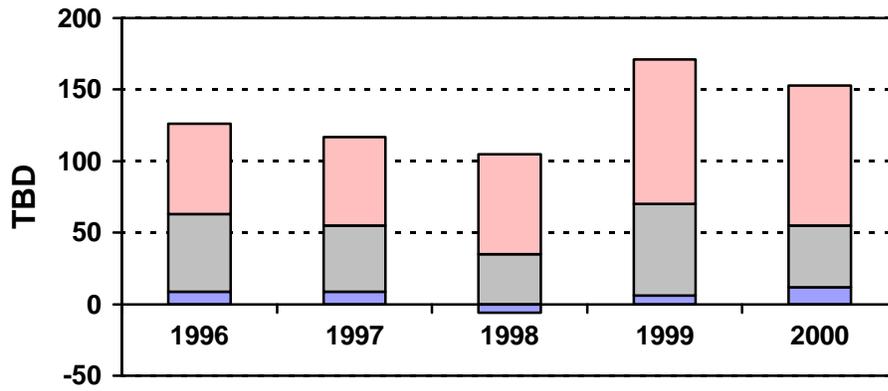


Over the past 5 years, imports of foreign crude oil into California have effectively tripled, from about 177 TBD in 1996 to nearly 500 TBD in 2000. While refinery crude runs have been nearly constant, the increased foreign imports are replacing both Alaska North Slope crude (ANS), as well as California crude production. The impact of the increased imports of foreign crude is relevant for the need to create a Strategic Fuels Reserve because:

- Foreign crude is sourced increasingly from remote locations such as the Middle East, requiring Very Large Crude Carriers (VLCCs) to achieve economical freight rates. The logistics of receiving larger cargoes from more remote locations increases the risk of supply disruptions.
- At many terminals and refineries, crude and product receipts share common infrastructure such as docks, transfer lines and sometimes even tankage. The additional maritime receipts of crude oil create an additional strain on product import capabilities.

Net product imports have grown from a small volume that resulted as the net sum of almost balancing imports and exports, to more than 220 TBD of net imports. Figure 1.3 shows the details of net imports by product category and origin.

Figure 1.3 – CA Imports of Petroleum Products<sup>5</sup>



\* Components include oxygenates such as MTBE, ETBE, etc

As can be seen from Figure 1.3, the increase in imports is most significant in jet fuel, but in all major fuel categories including diesel and miscellaneous other fuels (fuel oil, distillate blendstocks, lube stocks and additives), California has become import dependent, with gasoline and gasoline blending components forming the largest import category.

Imports of petroleum products are a function of refinery performance and regional demand. The California refineries operated reliably in 1998, but significant refinery problems were encountered in 1999. The large increase in imports from 1998 to 1999 as seen in Figure 1.3 reflects this difference in refinery performance. The underlying trend is an annual increase in waterborne imports of petroleum products in California of 30 TBD per year, or approximately 1.6% per year of the total fuels capacity of the State's refineries.

Figure 1.3 also shows that, while in 1996 California still was a net exporter of distillates and miscellaneous refined products, it now has a net import requirement in all product categories. Moreover, while in 1996 foreign imports accounted for approximately 50% of California's imported shortfall of gasoline and blending components, by 2000 the share of foreign imports had grown to almost 70%.

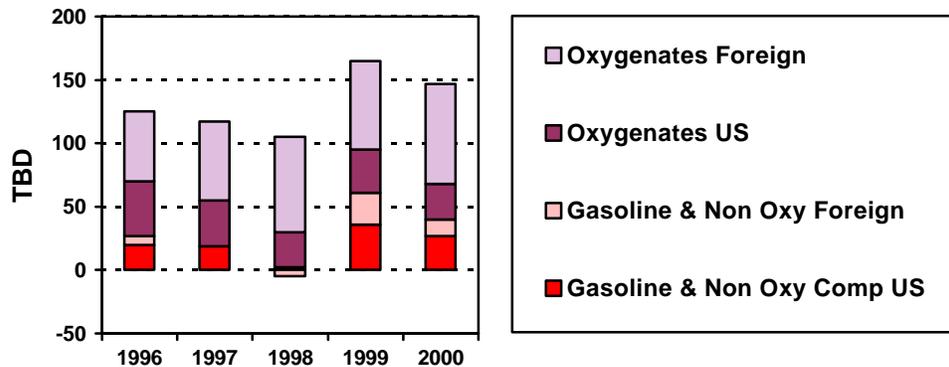
<sup>5</sup> Based on EIA data and Port Statistics collected by the US Army Corps of Engineers

Gasoline imports peaked at about 66 TBD in 1999, and remained at high levels in 2000. Although better refinery performance in 2000 was one of the reasons that import volumes leveled off after peaking in 1999, other factors also played a significant role in limiting imports in 2000:

- Refinery capacity in the US Gulf Coast tightened up substantially, reducing the availability of blending components from one of the major export centers.
- Jones Act shipping capacity became further restricted as first OPA 90 vessel retirements started.
- California terminal capacity capable of receiving waterborne imports became increasingly hard to find, and in several instances, importers were unable to offload cargoes.

The imports into the gasoline pool are a combination of finished gasoline, blending components and oxygenates. Components include alkylate, naphtha, reformate, raffinate, and natural gasoline. Oxygenates in the form of MTBE and ethanol make up the largest part of the imported shortfall of gasoline in California, with MTBE representing over 90% of these volumes. Indigenous Californian production of MTBE, TAME and ethanol is less than 12 TBD, underscoring the import dependency of California for this fuel additive. Figure 1.4 shows gasoline imports by component.

Figure 1.4 – CA Gasoline and Component Imports <sup>6</sup>



As can be seen in Figure 1.4, foreign imports accounted for approximately 50% of California's imported shortfall of gasoline and blending components in 1996. By 2000,

<sup>6</sup> Based on EIA data and Port Statistics collected by the US Army Corps of Engineers

the share of foreign imports had grown to 70%, and it is important to note that in fact, the entire increase in California's imports of gasoline over the period has been met by foreign imports rather than imports from other US refining centers.

The increasing dependency on foreign imports represents significant exposure for the future capability to keep the State supplied with gasoline because only a limited number of foreign refineries is capable of producing CARB spec fuels, and this number will shrink even further as some of these refiners will not be able to produce CARB Phase III CARBOB. To the foreign refiners, exports to California are only an incidental occurrence with uncertain margins given the shipping delays, the volatility of the Californian market, and the lack of a futures market. Under these conditions, it is difficult for these refiners to justify investments in the necessary upgrades.

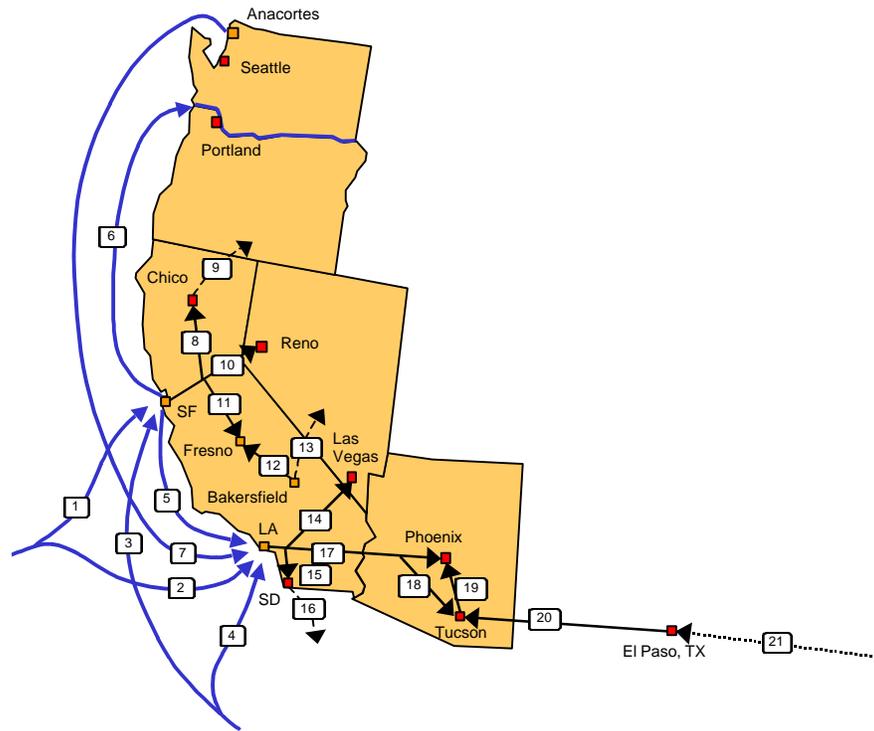
### *1.1.3 Interstate Product Movements*

The import volumes shown in Figure 1.4 for the West Coast represent the balance of imports and exports to the Pacific Coast states, which have a considerable volume of petroleum movements between the various producing and consuming enclaves. Refineries in the Bay Area ship conventional gasoline to the Pacific Northwest, primarily to Portland, OR. The refineries on Puget Sound send somewhat larger volumes of reformulated gasoline or components down to San Francisco or Los Angeles by tanker or barge.

Besides maritime imports, pipeline and truck movements play an important role in the supply of California and the neighboring states for which California refineries provide a significant share of their fuels demand. There are two major pipeline systems, both owned and operated by Kinder Morgan Energy Partners LLC, one exporting products from the Bay Area refiners to Northern and Central California, as well as Northern Nevada, and the other taking products from the LA Basin refiners to Southern California, Southern Nevada and Arizona.

Kinder Morgan also owns a pipeline system that moves products produced in Texas and New Mexico from El Paso to Tucson and Phoenix. Capacity on this system is oversubscribed, and capacity for users of this line is prorated. Figure 1.5 gives an overview of movements on product pipelines and other means of transportation between California and its neighboring states. Numbers are for the year 2000 and are based on data obtained from EIA, CEC and the US Army Corps of Engineers.

Figure 1.5 – CA 2000 CA Product Movements



Year 2000, TBD	Gasoline	Diesel	Jet
1 Foreign Imports into N-CA	29.8	0.6	13.0
2 Foreign Imports into S-CA	68.4	19.0	71.9
3 PADD III Imports into N-CA	6.8	n/a	n/a
4 PADD III Imports into N-CA	22.1	n/a	n/a
5 Ship/barge SF to LA	24.5	31.1	n/a
6 Ship/barge SF to Portland	28.0	2.7	n/a
7 Ship/Barge WA to LA	38.0	16.2	n/a
8 Kinder Morgan SF to Chico	17.6	n/a	n/a
9 Truck Chico into S-OR	0.4	0.5	n/a
10 Kinder Morgan SF to Reno	17.3	13.2	5.6
11 Kinder Morgan SF to Fresno	n/a	n/a	n/a
12 Kinder Morgan B'field to Fresno	n/a	n/a	n/a
13 Truck Bakersfield to W-NV	2.5	5.0	n/a
14 CALNEV LA to Las Vegas	45.9	32.3	32.7
15 Kinder Morgan LA to San Diego	n/a	n/a	n/a
16 Truck SD to Mexico	n/a	n/a	n/a
17 Kinder Morgan LA to Phoenix	60.9	28.4	29.5
18 Kinder Morgan LA - Tucson	4.1	2.6	0.5
19 Kinder Morgan El Paso - Phoenix	41.0	3.2	3.6
20 Kinder Morgan El Paso - Tucson	28.0	7.4	4.9
21 Longhorn	n/a	n/a	n/a

#### 1.1.4 *Supply Reliability Factors*

When refiners state calendar day capacity (actual expected annual production divided by 365 days) and stream day capacity (highest operating rate sustainable on a single day), the difference for major refinery units such as distillation or cracking is typically around 5%. This means that refiners expect that on average, these installations will be out of service for 18 days per year for scheduled inspections, preventive maintenance, operational activities such as catalyst changes, and project work. Since 1995, the California refineries have been running at operating rates equal to 95% of published nameplate capacity, which means that effectively, they have been running as close to their maximum sustainable rates as can be expected, given the age and complexity of the installations, and this operating record reflects favorably on the skill level and experience of operating personnel and refinery management.

Nevertheless, unplanned outages occur, sometimes for reasons that are completely outside the scope of control of the refinery management. For all of California's refineries combined, evidence was found in publicly available information that in the last 6 years, at least 54 outages occurred with measurable effect on production capacity. Of these, most are relatively minor events, with a production loss averaging 20 TBD over a period of less than 4 weeks. However, over this period there were 7 major events involving production losses ranging from 50 to 160 TBD and lasting up to 8 weeks.

With inventories on hand that average only 10 days of supplies, and with long supply routes requiring lead times of 6 to 8 weeks for imports, the effect of supply disruptions is to cause temporary shortages that in turn result in market driven price spikes, with prices running up until demand will be reduced to a level that corresponds with the reduced supplies. Given the very un-elastic price/demand behavior of gasoline, even small shortfalls in supply can cause very significant price swings. There is also ample evidence, as will be shown in Section 8 of this report, that even if incidents are confined to only one of the California refining centers, the entire California gasoline market moves up.

Supply reliability factors are not the only cause of price volatility. For instance, the lack of liquidity leaves the market vulnerable to sharp increases or decreases in posted prices on only a few reported deals. Yet in the majority of the cases, a real or imagined supply disruption is at the root of price volatility. In the most severe example, the refinery incidents in 1999 resulted in a capacity loss of 5 – 10%, and caused prices to double.

In general, price volatility in the California gasoline market has significantly worsened in recent years, as the insularity of the market increased while the spare capacity available within the California refining system to make up for supply disruptions decreased.

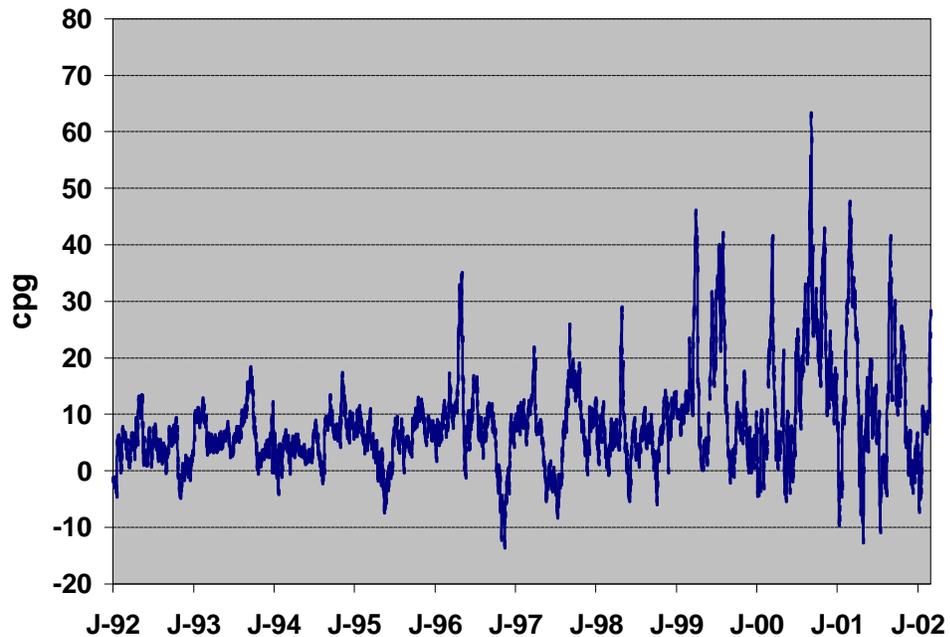
Figure 1.6 – Gasoline Spot Price Differential LA – US Gulf Coast <sup>7</sup>

Figure 1.6 shows the premium of the LA conventional spot gasoline price over the spot price at the US Gulf Coast, the latter being a highly relevant marker price for gasoline worldwide. It is clear that the CA prices have gradually increased over world market levels, and that the volatility has significantly increased since 1995, when CARB Phase II was introduced.

Whereas an earlier price spike in 1996 led promptly to additional shipments from the US Gulf Coast to California at a rate equivalent to 50 TBD, more recent price spikes that far exceeded that of 1996 in amplitude and duration have failed to attract more than 10 to 15 TBD. Although the market still functions in so far that no actual shortages have occurred at the pump, it must be concluded from Figure 1.6 that currently, the California gasoline market is not adequately supplied. In a well functioning market, supplies would be attracted at levels just above transportation and sourcing cost differentials, and prices would not have to run up until demand is reduced to match the insufficient offering.

## 1.2 Demand

To estimate future demand for transportation fuels in California, this report will make extensive use of the results of a separate study launched by the CEC concurrently, with the specific

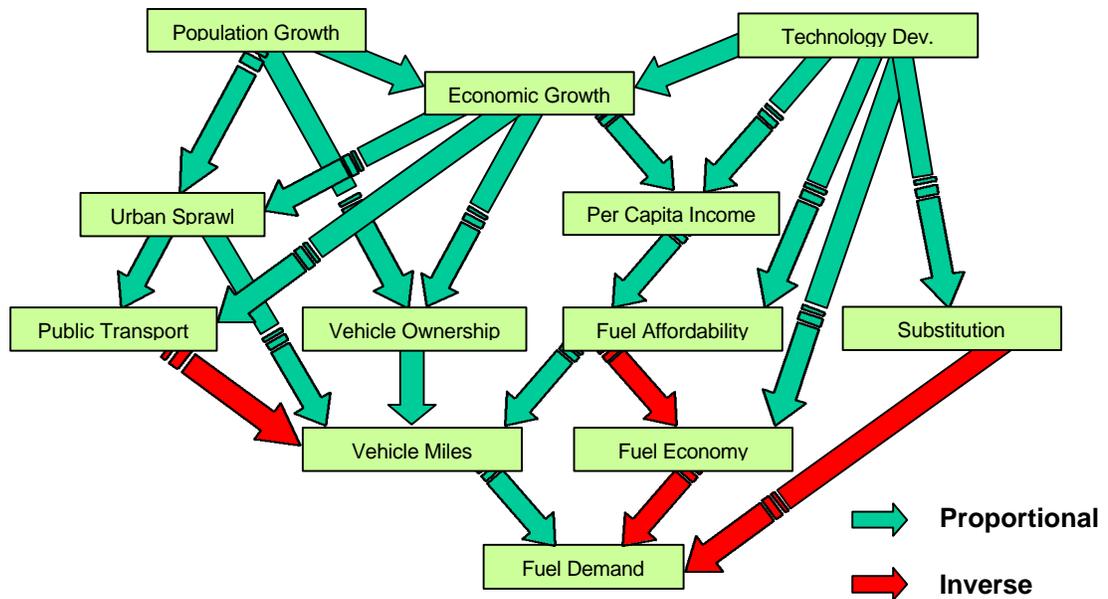
<sup>7</sup> EIA Daily gasoline spot prices Los Angeles and US Gulf Coast.

purpose of forecasting energy demand in the State<sup>8</sup>. The main findings of this study are summarized below.

1.2.1 Growth Drivers

Demand for transportation fuels is the product of the total miles driven by all vehicles and the average fuel consumption per vehicle over the entire fleet. These two key factors, in turn are impacted by a complex set of interdependent factors as shown in Figure 1.7 below.

Figure 1.7 – Drivers for CA Gasoline Demand



For the key factors, the following historical and forecasted numbers were used:

- Population Growth.** Over the past two decades, California's population grew by an average of 1.9% per year, a rate that is expected to slow to 1.4% per year over the next 20 years, resulting in a total population of 45 million people in the State by 2020.

<sup>8</sup> Base Case Forecast of California Transportation Energy Demand, CEC Staff Report, December 2001

- **Population Density.** Land development patterns in California are characterized by urban sprawl, leading to jobs and communities that are increasingly further apart. This trend is expected to continue.
- **Fuel Affordability.** Over the past 20 years, the average annual increase in per capita income in California was 3.1% per year, for an aggregate real increase of 45% (1.9% per year). Over the same period, the real cost of gasoline in the State fell by 30%. Per capita income is forecasted to increase on average 1.5% per year, and primary energy cost to stay flat in constant dollar terms (the price of gasoline in CA may vary significantly depending on supply scenarios, but this effect is taken into account separately).
- **Vehicle Miles Traveled (VMT).** The factors cited above contributed to an increase in total Vehicle Miles Traveled of 3.3% annually over the past 20 years. For the immediate future, the forecast is for an annual increase of 1.8%.
- **Substitution.** Public transportation and alternative fuel vehicles can substitute demand for conventional gasoline powered personal cars. However, the CEC estimates do not show a significant impact of alternative technologies in the near future.

### 1.2.2 Scenarios

For near term future gasoline demand scenarios, i.e., forecasts that extend up to five years out, the most leveraging differentiators are general economic climate and basic energy price levels, in particular the price of crude oil. Other factors, such as demographic changes of changes in fleet composition and average fuel efficiency, move too slowly to have a significant impact within a five-year time horizon.

Three scenarios were evaluated:

- A base case that assumes the current economic slowdown to level off, with a moderate recovery over the next two years and slower growth afterwards than seen over the past five years, resulting in an average increase in gasoline demand of 1.6% per year
- A high growth scenario that assumes rapid economic recovery to similar levels as seen over the past five years, averaging 2.1% per year.

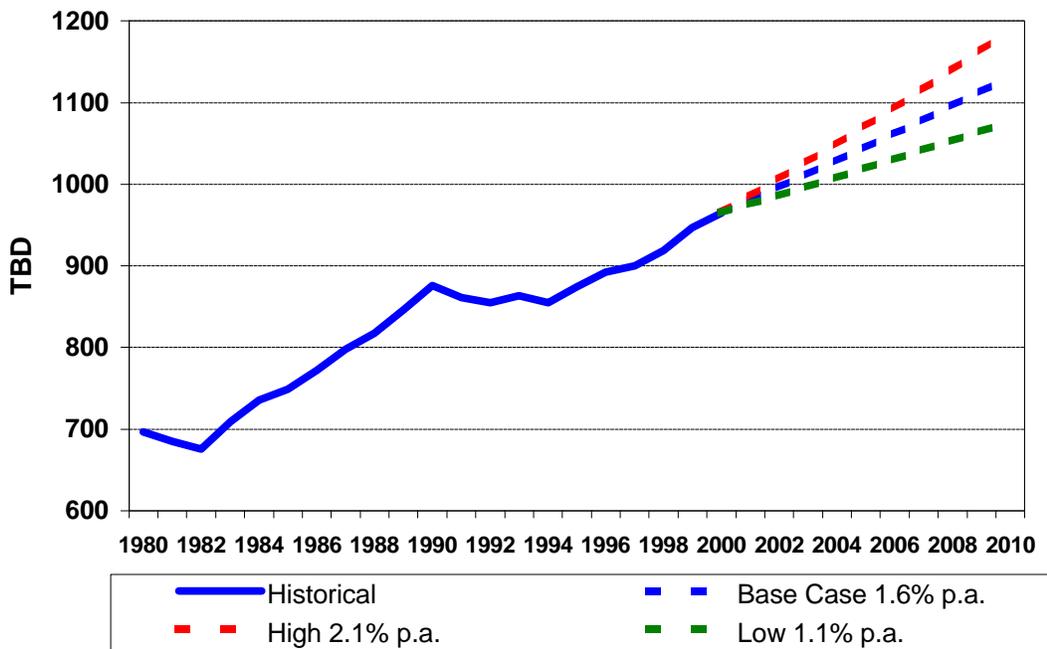
- A low case assuming a deepening and longer lasting recession, with gasoline demand growth slowing to 1.1% per year

All scenarios assume that crude oil prices will stay moderate, i.e., in a range of \$20 per barrel, plus or minus \$5. Because crude oil pricing is an almost straight direct cost pass through in gasoline prices, higher and lower crude prices will impact gasoline demand with virtual the same price elasticity as gasoline price excursions caused by local market supply imbalances. A high growth scenario could therefore also occur when economic recovery is delayed but crude prices revert to the low prices seen in the late nineties. It would take a combination of very high crude prices and a severe recession, similar to what was observed in the early eighties and early nineties, to cause gasoline demand to stay flat or show negative growth. The probability of this reoccurring is deemed extremely unlikely.

### 1.2.3 Demand Projections

Figure 1.8 shows the historical demand of gasoline in California, excluding the gasoline demand for those parts of Arizona and Nevada that are supplied out of California.

Figure 1.8 – California Gasoline Demand Forecast



The base case growth forecast is a close approximation of the long-term average annual increase over the entire period 1980 through 2000, while the upside and downside cases represent periods of rapid economic expansion and moderate

recession respectively. Only a severe recession caused by or coinciding with crude oil prices in excess of \$30/bbl have led in the past to scenarios in which gasoline demand in California stayed flat, or even showed modest decreases. This was the case in 1980 and in 1990 – 1993, but current signs of economic recovery as well as a stated policy by OPEC and non-cartel producing states to manage crude oil prices within ranges that do not harm world economies make a return of similar conditions unlikely in the immediate future.

1.2.4 *Arizona/Nevada Demand*

As shown in Section 1.1.3, California refiners supply fuels to Nevada and Arizona, which includes some of the fastest growing urban centers in the US. Table 1.2 shows the demand forecast for the California sourced demand in these states.

Table 1.2 – Arizona and Nevada Gasoline Demand

Growth Drivers											
Northern Nevada Growth (1)	2.9%	2.8%	2.7%	2.6%	2.5%	2.4%	2.3%	2.2%	2.1%	2.0%	1.9%
Southern Nevada Growth (2)	6.4%	5.2%	4.5%	3.9%	3.4%	3.0%	2.7%	2.4%	2.2%	2.1%	2.1%
Arizona Population Growth (4)	2.4%	2.4%	2.3%	2.3%	2.2%	2.2%	2.1%	2.1%	2.0%	2.0%	2.0%
Gasoline Demand (TBD)											
Nevada											
Northern NV (3)	21.0	21.6	22.2	22.7	23.3	23.9	24.4	25.0	25.5	26.0	26.5
Southern NV (3)	41.0	43.1	45.0	46.8	48.4	49.9	51.2	52.5	53.6	54.8	55.9
	62.0	64.7	67.2	69.5	71.7	73.8	75.6	77.4	79.1	80.8	82.4
Arizona											
West Line Sourced	87.0	89.1	91.1	93.2	95.3	97.4	99.4	101.5	103.5	105.6	107.7
East Line Demand	75.0	76.8	78.6	80.4	82.1	83.9	85.7	87.5	89.3	91.0	92.9
East Line Supply (5)	75.0	75.0	75.0	75.0	75.0	75.0	185.1	189.0	192.8	196.7	200.6
Total West Line Supply (6)	87.0	90.9	94.7	98.6	102.4	106.3	0.0	0.0	0.0	0.0	0.0
<b>Total California Sourced Demand</b>	<b>149.0</b>	<b>155.6</b>	<b>161.9</b>	<b>168.2</b>	<b>174.2</b>	<b>180.1</b>	<b>75.6</b>	<b>77.4</b>	<b>79.1</b>	<b>80.8</b>	<b>82.4</b>

- 1 Nevada State Energy Office estimate 2.8% in 2001 vs. 2.9% in 2000, a decline assumed to continue
- 2 As per Clark County Advanced Planning Division - "Clark County Demographics Summary"
- 3 Lynn Westfall, UDS presentation to CIOMA, April 2001
- 4 AZ Dept of Economic Security data - <http://www.de.state.az.us/links/economic/webpage/page16.html>
- 5 Assumes replacement of West Line supplies by Longhorn extension to Phoenix in 2006
- 6 Assumes all AZ pipeline growth until start up of Longhorn extension to be put on West line due to East Line proration

The main event that will impact the supply of California sourced gasoline to Arizona is the anticipated completion of a new parallel or “looped” pipeline from Tucson to Phoenix, which will allow US Gulf Coast refiners to substitute California supplied volumes. The assumption here is that the US gulf coast refiners, who currently operate

at capacity, will be able to make these volumes available through refinery expansions, or by shifting products away from their current markets, which in turn would have to look for imports from foreign sources.

1.2.5 Total Demand

The total demand for gasoline to be supplied from California is shown in Table 1.3 below.

Table 1.3 – Total Demand for California Sourced Gasoline

	TBD	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
<b>Base Case</b>												
Northern California	372	378	384	390	396	403	409	416	422	429	436	
Northern Nevada	17	18	18	19	19	20	20	21	22	22	23	
Oregon	28	28	29	29	30	30	31	31	32	32	32	
	417	424	431	438	445	453	460	468	476	483	491	
Southern California	591	600	610	620	630	640	650	660	671	682	693	
Southern Nevada	41	43	45	47	48	50	51	53	54	55	56	
Western Arizona	87	91	95	99	102	106	0	0	0	0	0	
	719	734	750	765	781	796	701	713	725	737	749	
Total CA Base	1136	1159	1181	1204	1226	1249	1161	1181	1201	1220	1240	
<b>High Growth Case</b>												
Northern California	372	380	388	396	404	413	421	430	439	449	458	
Northern Nevada	17	18	18	19	19	20	20	21	22	22	23	
Oregon	28	29	29	29	30	30	31	31	32	32	33	
	417	427	435	445	453	463	472	483	493	503	514	
Southern California	591	603	616	629	642	656	669	684	698	713	728	
Southern Nevada	41	44	45	47	49	50	52	53	54	55	56	
Western Arizona	87	92	96	100	103	107	0	0	0	0	0	
	719	739	757	776	795	813	721	737	752	768	784	
Total CA High	1136	1165	1192	1220	1248	1277	1194	1219	1245	1271	1298	
<b>Low Growth Case</b>												
Northern California	372	376	380	384	389	393	397	402	406	410	415	
Northern Nevada	17	18	18	19	19	20	20	21	22	22	23	
Oregon	28	28	29	29	30	30	31	31	32	32	32	
	417	422	427	432	437	443	448	453	459	464	470	
Southern California	591	598	604	611	617	624	631	638	645	652	659	
Southern Nevada	41	43	45	46	48	49	51	52	53	54	55	
Western Arizona	87	90	94	98	101	105	0	0	0	0	0	
	719	730	742	755	767	779	682	690	698	706	715	
Total CA Low	1136	1152	1169	1187	1204	1222	1129	1143	1157	1171	1185	

Since no official scenarios were developed for demand growth in Arizona and Nevada, it is assumed that high growth in these states would be 1% per year above base case growth, while a reasonable assumption for low growth is 1% below base case.

### 1.3 Forward Looking Supply/Demand Balance

Ignoring inventory effects, supply and demand will have to balance. The total demand shown in Table 1.3 above is the latent demand, i.e., the demand that will exist if sufficient product is available to meet the demand at prices that are not significantly different from historical numbers. The main event impacting the supply is the phase-out of MTBE.

#### 1.3.1 Impact of MTBE Phase Out

Table 1.4 below shows the impact of the MTBE phase-out by region.

Table 1.4 – Impact of MTBE Phase Out<sup>9</sup>

	TBD	N-CA	S-CA	Total CA
<b>MTBE Balance</b>				
RFG production		386	549	935
Ethanol Based CARB RFG		40	70	110
MTBE Based CARB RFG		346	479	825
MTBE Required @ 11%		38	53	91
MTBE imports foreign		24	51	75
MTBE imports US Gulf Coast		7	10	17
MTBE production		7	3	10
Total MTBE supply		38	64	102
Excess MTBE		0	11	11
<b>Direct Impact</b>				
Removal of MTBE		-38	-64	-102
Ethanol addition for oxygen requirement		21	34	55
Removal of butanes & pentanes		-17	-29	-46
Other Losses to meet distillation specs		-4	-6	-10
		-38	-65	-103
<b>Capacity Compensation</b>				
Major refinery capacity additions		22	0	22
Small CARB III mods, MTBE C4 to alky		3	2	5
Capacity Creep 2001 - 2002, 1%		4	6	10
Identified blendstock imports by refiners		0	10	10
		29	18	47
<b>Net Shortfall</b>		<b>-9</b>	<b>-47</b>	<b>-56</b>

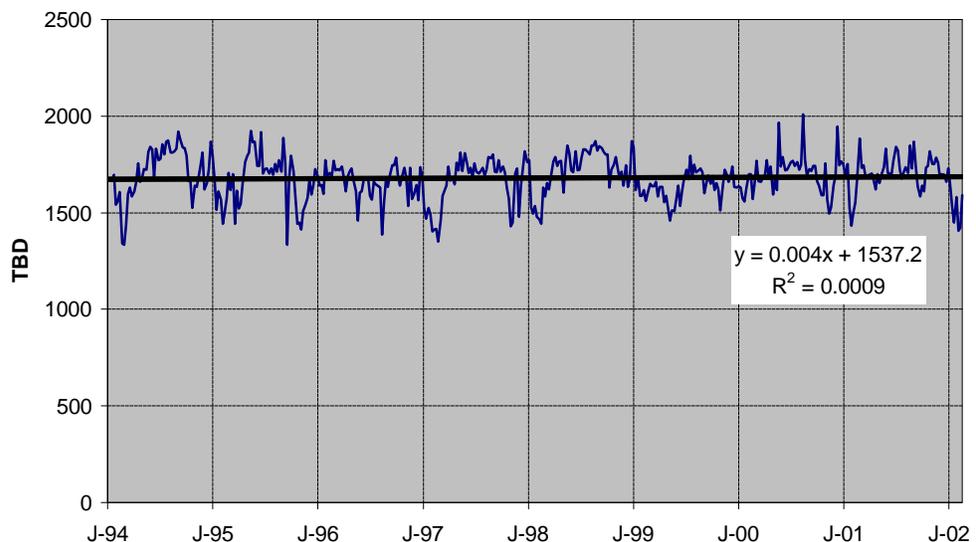
The 11 TBD shown in Table 1.4 as excess MTBE is the sum of 3 TBD shipped down the Kinder Morgan pipeline to Phoenix, an unknown quantity that was used because of supply problems with ethanol for the current substitution of MTBE by some refiners, and a significant quantity, possibly as high as 6 or 7 TBD of MTBE used by LA refiners to make up for volume and quality problems by blending in more than 11%.

The major addition in refinery capacity of 22 TBD shown in Table 1.4 above is not a net addition, but a partial conversion of conventional gasoline production into CARB Phase III grades<sup>10</sup>. It is clear from Table 1.4 that the southern California market will be impacted much more severely by the MTBE phase out than its northern counterpart. Moreover, the LA Basin is more constrained in terms of import capabilities than the Bay Area, making the south more vulnerable to supply shortages.

### 1.3.2 Capacity Creep

Capacity creep is the term used for the result of ongoing small plant improvements in refinery operations. Even though small, capacity creep is an important phenomenon because it can compensate for a significant portion of demand growth. In the absence of major expansion projects, capacity creep can be derived from production numbers over time. Figure 1.9 shows the weekly reported crude runs of California refineries.

Figure 1.9 – Reported Crude Runs by CA Refiners



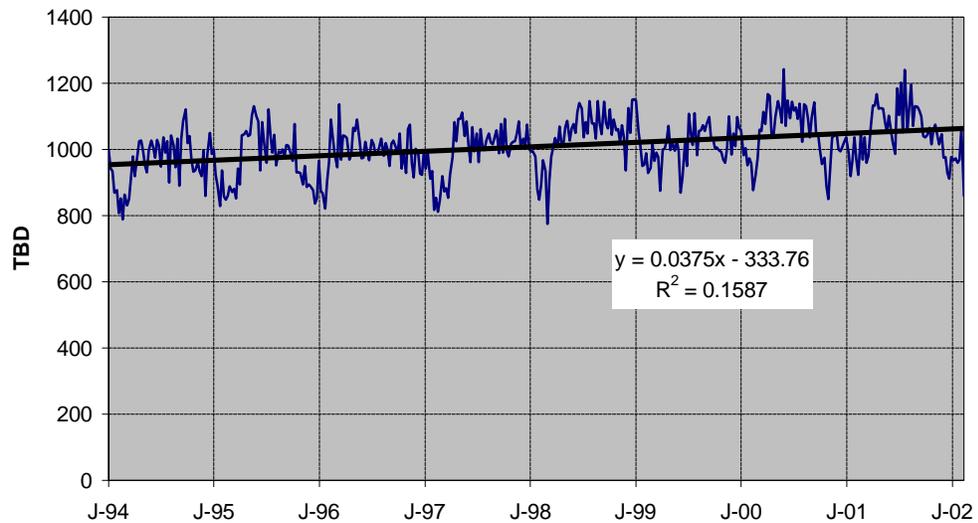
<sup>9</sup> Source of Data: CEC, CARB Phase III Compliance Plans as submitted by refiners Q4, 2001

<sup>10</sup> Information received during Stakeholder Meetings.

Although crude runs by California refiners have stayed virtually flat over the last 8 years, gasoline production has seen a small but significant increase in production, as shown in Figure 1.10 below.

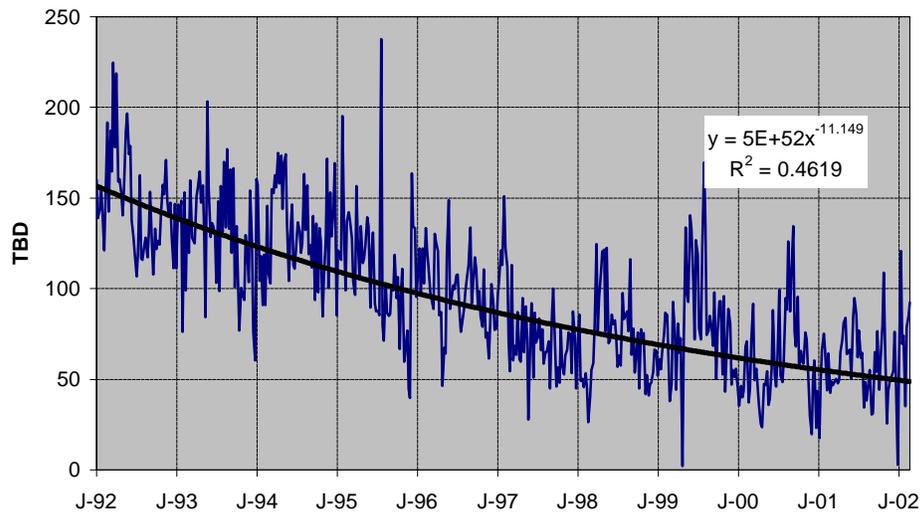
Gasoline supplies by California refineries have grown on average by 1.3% per annum over the period 1994 through 2001, for an overall increase in average reported gasoline production of close to 100 TBD. Of this additional volume, approximately 40 TBD is due to increased receipts of imported blending components, which get reported as production after being blended off. The remainder, or 60 TBD, is the effect of the result of minor expansion projects and ongoing improvements in operations, which equates to approximately 0.6% per year. Although insignificant as fraction of total supply, capacity creep is important because it can represent up to half of the anticipated increase in demand.

Figure 1.10 – CA Weekly Reported Gasoline Production



As can be seen in Figure 1.10 and 1.11, the increase in gasoline production by California refiners by about 100 TBD was accompanied by a corresponding decrease in production of residual fuels, confirming that within the virtually flat crude conversion, refiners have been able to convert more of the heavy end of the barrel into gasoline. A small shift in distillate production can also be observed, but is not shown here. It is clear from Figure 1.11 that the capability to convert more heavy components into gasoline is reaching a point where further improvements are not physically possible.

Figure 1.11 – CA Weekly Reported Production of Residual Fuels



In a market where supplies are tight, and where economic justification for small improvement projects can readily be found, capacity creep is likely to continue at historical rates. However, it is becoming increasingly difficult for refiners to expand capacity even by small increments because of restrictions imposed by their CAAA Title V operating permits, and the costs of additional emission credits in the absence of feasible offsets.

For the base case projections, the annual increase of gasoline production is assumed to 1.0% per year. This rate of increase does not include known or expected discrete capacity additions through major bottleneck or expansion projects, nor does it account for the impact of specific programs such as the CARB Phase III compliance.

### 1.3.3 Major Refinery Projects

Other than the project to convert 22 TBD of conventional gasoline into CARB RFG in the Bay Area, there are few other major expansion projects that have been announced. It is estimated that a prolonged period of high price levels will provide a justification for other capital projects and may result in an additional 23 TBD of gasoline in the Bay to come on stream in 2005, which is the reason for the increased supplies shown in Figure 1.11 below for Northern California.

Other major projects, such as the expansion of a crude unit in LA and the restart of the idled Powerine refinery by CENCO, met with strong environmental opposition, which, in conjunction with marginal economics, has caused these projects to be abandoned.

1.3.4 Northern California Supply/Demand Balance

For the base case demand, Figures 1.12 and 1.13 show the supply/demand balance for Northern and Southern California respectively.

Figure 1.12 – Northern CA Gasoline Supply/Demand Balance

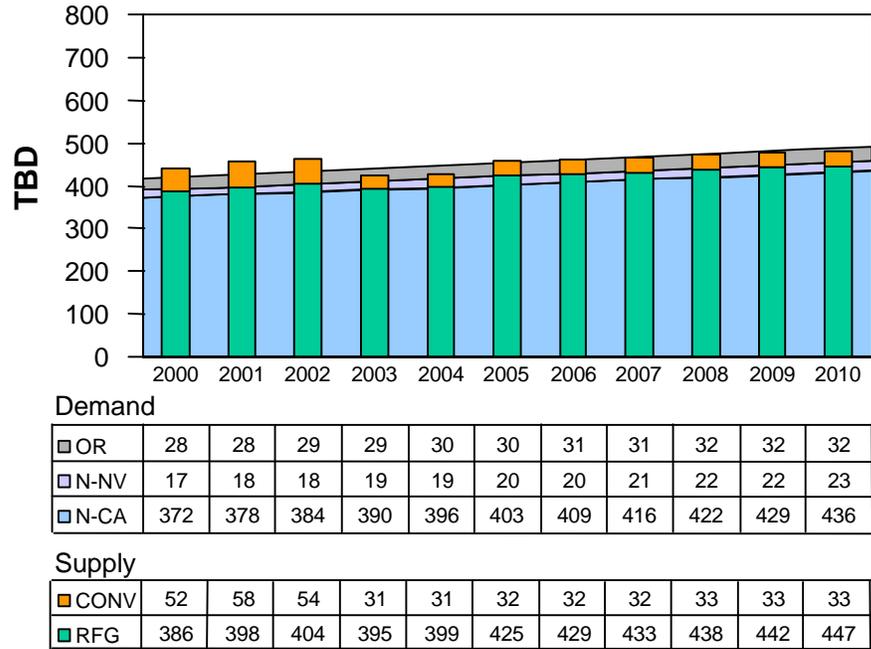
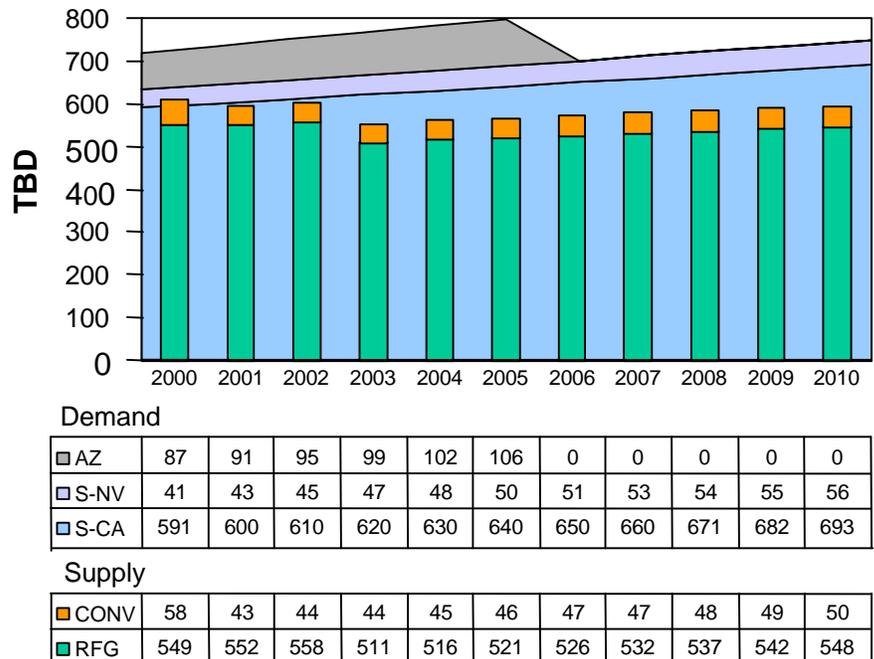


Figure 1.13 – Southern Gasoline CA Supply/Demand



From Figures 1.12 and 1.13 it will be clear that whereas northern California is only minimally impacted by the MTBE phase out, southern California will see its import dependency – which is represented in the charts as the difference between the areas and the bars – approximately double. More importantly, the south currently depends for its shortfall in CARB RFG on barge imports from the Bay Area to the LA Basin by barge.

While the Bay area will be roughly balanced again once the all planned major refinery projects are completed, the south will still be significantly short even when the Longhorn pipeline will be extended to Phoenix. The shortfall will be even more acute when a rapid economic recovery will spur the demand to growth rates of 2% and more, as seen in 1996 – 2001.

### *1.3.5 Price and Volatility Effects of Shortfall*

The effect of price on demand of gasoline, often referred to as the price elasticity of gasoline demand, is defined as the percentage change in the demand of gasoline divided by the percent change in price. Thus, a price elasticity of – 0.1 for example, suggests that a 20% increase in price would correspond to a 2% fall in demand.

The price elasticity for gasoline is not a constant number over a wide price range, but will be a function of other factors. For instance, the overall price level will play an important role: at low overall price levels, i.e., when crude oil and energy prices are low, the same percentage price increase will not have the same impact on demand than an increase when prices are already high. Also, general economic conditions and regional factors such as ready availability of public transportation alternatives will play a significant role. For instance, in the Bay Area, where a well functioning public transportation alternative exists, short-term responsiveness will be different from the LA Basin.

Moreover, there will be a significant difference between short-term responsiveness and long-term elasticity. Longer term, the effect of continued high pricing, such as that caused by fuel tax policies in many parts of the world, will have an impact on overall vehicle fleet fuel economies, use of alternatively powered cars, additions of public transportation infrastructure, and changes in demographic factors such as urban sprawl. Most of these factors take between 5 and 10 years to have a noticeable effect on consumer behavior. Short-term, the effect of these factors is negligible. Therefore it is not surprising that estimates given in table 1.5 below have fairly wide ranges.

Table 1.5 – Gasoline Price Elasticity

	Short-Term	Long-Term
FTC (2001) Midwest Gasoline Investigation	- 0.1 to - 0.4	Not reported
WSPA (2001) (PIRINC study)	- 0.05	Not reported
API (Porter) (1996)	- 0.19	- 0.71
Haughton & Sarkar (1996)	- 0.12 to - 0.17	- 0.23 to - 0.35
Espey (1996)	Not reported	- 0.53
Goel (1994)	- 0.12	Not reported
Goodwin (1992)	- 0.27	- 0.71 to - 0.84
Sternier (1992)	- 0.18	- 1.0
World Bank (1990)	- 0.04 to - 0.21	- 0.32 to - 1.37
Dahl (1986)	- 0.13 to - 0.29	-1.02

The reported numbers put short-term elasticity in the range of – 0.04 to – 0.40, and long-term elasticity in the range of – 0.23 to – 1.37. Observed behavior in the California market in 1999, when a 5 -10% shortfall in supply caused prices to double before demand again matched the reduced supply, suggests a short-term elasticity of – 0.05 to – 0.1. Essentially, in 1999, a series of major and minor unplanned refinery outages caused shortages ranging from 50 to 80 TBD. Although most of these outages occurred in the Bay Area refining center, spot prices in both Northern and Southern California quickly rose to more than double the prior level. The elevated price levels were sustained over periods of 4 to 6 weeks at the time, with severe price volatility in between, and only came down after one of the affected refiners applied to the California Air Resources Board for a waiver to supply non-conforming gasoline.

For the purpose of this study, which is primarily concerned with price volatility, only the short-term elasticity is of interest. Moreover, in the case of a supply disruption such as a refinery outage, the causality is often price-based. Once an outage is known in the market, traders and refiners will take positions that rapidly drive up the spot market price. Although somewhat sheltered, retail markets follow, especially if the supply disruption is significant in magnitude and duration. The higher prices will thus cause demand to drop following established price elasticity mechanisms as described above, even before demand exceeds the available supplies, including the draw-down of inventories. This market behavior will be analyzed in more detail in Section 7 below.

## 1.4 Alternatives to make up Shortfall

In the absence of any real possibilities to increase production within California over the capacity creep and discrete projects already taken into account in the base case supply, alternative supplies to make up the projected shortfall consists in the short term of increased imports from other US producing regions, or from foreign sources. Longer term, supplies can be anticipated from pipeline projects now under development.

### 1.4.1 *Supplies from US Gulf Coast*

The US Gulf Coast is the largest refining center in the US, and as such is a logical place to consider when looking for alternative supplies to meet California's shortfall. It has always been recognized that the CARB Phase III requirements would make sourcing finished product or CARBOB from the PADD III refineries difficult, but it is the availability of other blendstocks that needs to be evaluated, as well as the capabilities of the transportation system to move any available product to the West Coast.

Currently, several US Gulf Coast refineries are capable of producing gasolines that at or near CARBOB II specifications, and most of these have made occasional shipments to California in the past. However, it is not economical for these refineries to invest in the necessary upgrades to be able to produce Phase III base blendstock, because of the limited overall production capability of the boutique quality material, the incidental nature of the export shipments, and the emergence of other premium markets for the these type of blendstocks such as the Chicago market, where high margins can be realized without the need for additional investments<sup>11</sup>.

Not only is there no justification for Gulf Coast refiners to upgrade their capabilities to meet California specifications, there is also not much spare capacity in the PADD III system overall. Much like the refineries in California, the refining centers on the Gulf Coast are currently also operating at or near maximum sustainable operating rates. Refineries in the US as a whole and on the Gulf Coast in particular, have seen a steady increase in overall capacity utilization as expressed in total crude runs, from average levels of 85% in the early nineties to at or even above calendar day capacity during the seasonal peak demand periods in recent years<sup>12</sup>. Similarly, capacity utilization in the main gasoline-producing unit within most Gulf Coast refineries, the

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<sup>11</sup> Information received during a Stakeholder Survey Meeting conducted for the CEC's Strategic Fuels Reserve Study.

<sup>12</sup> Source data: EIA

Fluidic Catalytic Cracker (FCC), has seen a steady increase and the total FCC capacity is fully utilized. In fact, demand now consistently exceeds capacity, and New York harbor depends on foreign imports to balance supply and demand. This means that any product shipped from the Gulf Coast to California will back out pipeline volumes to New York and will result in additional foreign imports into the Eastern states.

Besides finished gasoline or near finished blendstocks, a key gasoline component exported from the US Gulf Coast is alkylate. The choice blending component, which best fits the particular needs of the California refiners, is C7 alkylate, which is produced by combining propylene and butanes in a reaction that is catalyzed by sulfuric acid or hydrofluoric acid in a process that requires some of the most stringent safety and environmental precautions of any refinery installation.

Because alkylation units are inherently more hazardous than most other refinery operations, they have been more difficult to build and to expand because permitting is not always possible. Also, the uncertainties surrounding feedstock availability and alternative market values make investment decisions difficult. As a result, while the Gulf Coast refiners have been able to increase their capacity in FCCs and cokers, alkylate capacity has remained virtually flat. Moreover, alkylation units compete with many chemical industries for propylene, which usually commands much higher prices in chemical applications than its value in the automotive fuel pool.

The issue of competing uses for propylene impacting the availability of C7 alkylate, and the difficulty of substituting C8 alkylate given current T50 restrictions, was extensively discussed by Cal Hodge<sup>13</sup> in the context of a CARB workshop held November, 2000. The conclusion drawn at the time still seems valid, in that alkylates may play some role in meeting California's projected shortfall, but their overall contribution is likely to be limited to small volumes, i.e. one cargo per month, at a significant premium.

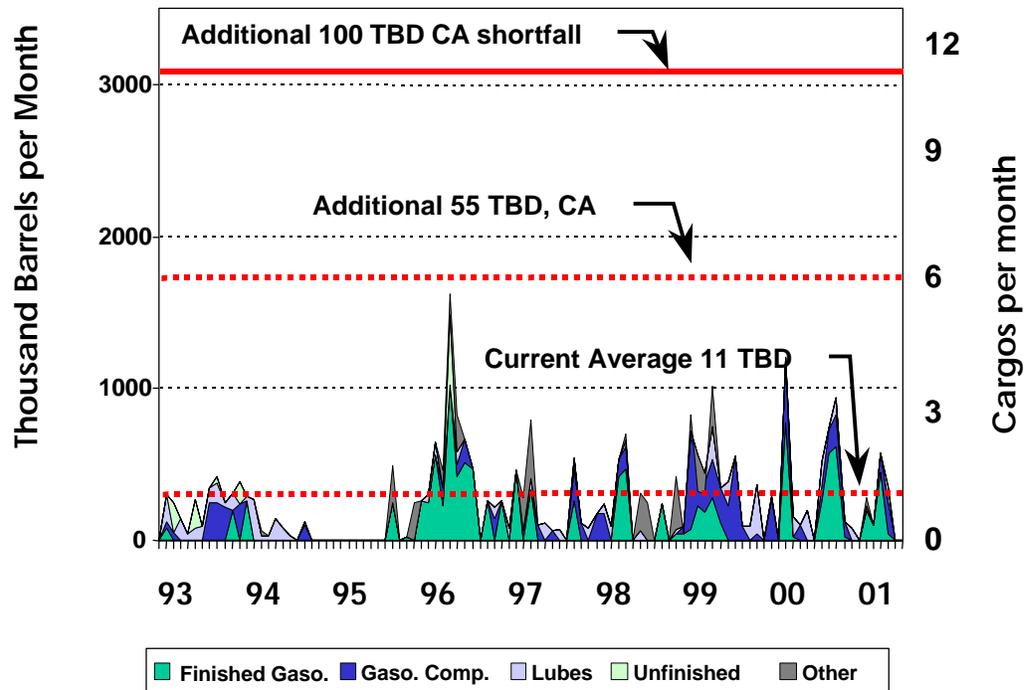
Finally, even if the US Gulf Coast were capable of producing additional gasoline blendstocks or components, there would not be sufficient Jones Act (prohibits the use of foreign flag vessels between US ports) product tankers available to transport quantities of 55 to 100 TBD, which is five to 10 times higher than the current volumes moved from the USCG to California. The impending phase out of single hull product tankers under OPA 90 severely reduces the availability vessels even further, making it necessary to rule out the US Gulf Coast as a short-term supply source.

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<sup>13</sup> Letter by Cal Hodge, A2Opinion, to Alan C. Lloyd, Ph.D., Chairman of CARB, December 15, 2000

It was shown earlier in Figure 1.6, that there is a rising trend with increasing volatility in the premium that California is paying over the Gulf Coast for its gasoline supplies. But while a price spike in 1996 was able to attract volumes from the US Gulf Coast at a rate corresponding to approximately 50 TBD, (see corresponding spike in shipping volumes in Figure 1.14 below), subsequent sustained and higher price differentials in recent years have triggered only moderate volumes to be shipped from the Gulf Coast. This confirms that increasingly, the US Gulf Coast and California have become disconnected markets, with quality requirements and lack of logistical means acting as barriers to supply.

Figure 1.14 – Maritime Movements of Petroleum Products USGC – CA



The conclusions that can be drawn from the analysis of US Gulf Coast supply options are that:

- Finished or near finished gasoline will not be available for CARB Phase III.
- Components will be available at premiums that correspond to local blending value plus replacement imports costs.

- The choice blending component, C7 alkylate, is not available as a segregated stream and can only be sourced as a blend of mixed alkylates at premiums corresponding to alternate use of propylene as chemical feedstock.
- Even if blendstocks can be located, there will not be sufficient shipping capacity to move the products from the US Gulf Coast to California

The development of the gasoline price differential between California and the Gulf Coast over recent years supports these conclusions.

#### *1.4.2 Supplies from Other West Coast States*

The State of Washington has a major refining center on Puget Sound. In 2000, the Washington refineries shipped around 47 TBD of gasoline and blending components to California, while California exported 35 TBD to Oregon of conventional gasoline<sup>14</sup>. California refiners, who own three out of four of the major refineries in Washington, often move products between Washington and California in order to optimize their material balances. Given prevailing market incentives, it appears that the current volumes represent the maximum feasible interstate exchanges, i.e. if significant spare capacity had existed, it would have been used. It is anticipated that a chronic shortage of fuels in California will lead to further optimization of these inter-refinery balances and that Washington refineries, after investments, may be able to increase their exports to California by 10 TBD.

#### *1.4.3 Foreign Imports*

Imports of foreign gasoline and blending components other than oxygenates have increased from erratic small net exports or imports in the early nineties to a level of 20 to 25 TBD in recent years. As with US Gulf Coast supplies, the availability and the logistics will have to be examined in order to establish what role foreign sources can play in alleviating a California supply shortfall.

Currently, several foreign refiners are capable of producing conforming CARB Phase II gasoline or “near-BOB”, base-stock gasoline that only needs the addition of MTBE to be on spec. Most of these have shipped occasional cargoes to California over recent years. A survey of these refiners completed as part of the Strategic Fuels Reserve Study currently underway revealed that only the Irving refinery in New Brunswick will

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<sup>14</sup> US Army Corps of Engineers Waterborne Commerce Statistics Center

be able to supply Phase III CARBOB, in quantities of up to two cargoes per month or the equivalent of 18 TBD. These supplies do not require Jones Act shipping and can therefore be delivered at competitive freight rates (8 cpg) and at relatively short notice (3.5 weeks transit). It is likely that most or all of this material will find its way to California if supply shortages will cause prices in California to depart substantially from East Coast levels, where the New Brunswick refinery currently sells most of its output.

Another potential source of Canadian material is Alberta's Envirofuels, which is likely to convert its 18.5 TBD of MTBE production into an estimated 11 TBD of isooctane. This material is targeted for the California market, and the project is likely to be driven by the need to move condensates from natural gas production rather than stand-alone economics, which would have forced Envirofuels to require significant premiums, given the conversion cost and the complicated logistics to move product from Edmonton, Alberta, to CA. Chevron, who is part owner in this venture, is likely to keep their share of the output within the Chevron system and use infrastructure released from MTBE service, while shareholder Neste may put their volume onto the open market.

In the Middle East, a new venture currently produces approximately 10 TBD of Phase II RFG, based on blends of isomerate and reformat. This facility has plans to increase production to 25 TBD, and make improvements to meet CARB Phase III specs. With current freight rates of 10 to 12 cpg, first supplies from this source have started moving into California in the fall of 2001.

Other than the three specific foreign sources of CARB Phase III blendstocks, it can be safely assumed that the international majors such as ExxonMobil, BP and Shell, will be able to optimize the availability and usage of high quality blending components within their global refining systems, such that these materials will be routed to California when a price departure offers an opportunity to maximize corporate revenues on a global basis.

All in all, it would appear therefore that additional supplies up to 50 TBD could be mobilized at premiums over world market pricing that are not too different from price levels at which California currently buys its incremental barrel, although this volume does not appear to be committed to California at this time. Whether global availability of premium blendstocks will allow sourcing of 100 TBD seems a little more doubtful at this stage, but given sufficient incentive, i.e., if California's prices were to remain for a prolonged period at levels of more than 50% over world markets, then it is likely that the State will attract every available conforming barrel that refiners around the world can segregate and ship. *The problem therefore becomes one of import logistics, and herein*

*lies one of the key contributions a Strategic Fuels Reserve can make, provided it is designed to increase the State's capacity to imports fuels.*

#### 1.4.4 Pipeline Supplies

One of the alternatives to supply California's shortfall is to transport products by pipeline from the US Gulf Coast. The issue here is not just that it requires pipelines that will move finished products from the refining center on the US Gulf Coast to the West Coast across 1500 miles of distance, but also that the availability of West Coast quality products on the US Gulf Coast is uncertain.

The bulk of West Coast sourced demand in Arizona goes to Maricopa County – Phoenix and the surrounding cities. The stringent quality of gasoline for this area is very similar to California's gasoline quality. The issue is that demand for low sulfur gasoline will increase dramatically East of the Rockies (EOR) when the EPA reduces sulfur levels of all grades of gasoline in 2005. In the face of increasing local demand, supplies of low sulfur RFG will have to be bid away from local markets in order to move them to Arizona. This supply equation will be further complicated if Arizona decides to blend ethanol with gasoline in Maricopa County in the summer. An ultra low RVP blendstock, similar to CARBOB will be required.

The existing pipeline network for Southern California, Southern Nevada, and Arizona originates in Los Angeles. Product is moved by Kinder Morgan Energy Partner's pipeline from Los Angeles to San Diego, Las Vegas, and Phoenix. The LA to Phoenix system is known as the West Line. Some volume from Los Angeles also moves past Phoenix to Tucson.

Longhorn Pipeline is in the process of building a line from the refining center in Houston to El Paso. The company expects to have construction completed early 2002, although the progress of the project has been significantly hampered by objections of the City of Austin, Texas. These issues now appear to have been resolved and the first products could delivered into El Paso by the middle of 2002. Initial rate will be 75 TBD. The line's capacity can be expanded to 225 TBD with the construction of additional pump stations <sup>15</sup>.

Because demand for the existing Kinder Morgan East Line from El Paso to Tucson and Phoenix exceeds its capacity, with flows for each customer being prorated, this line will

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<sup>15</sup> Meeting with Longhorn Pipeline, CEC, CARB, Interliance, and Stillwater Associates, December 12, 2001

have to be de-bottlenecked or a separate pipeline will have to be built to move the product that Longhorn can deliver to the Tucson and Phoenix markets. It is estimated that this separate line, or loop, in pipeline terms, could be completed by 2005. If products are available from the Gulf Coast, they could displace all or part of the 93 TBD forecasted to be exported from California in 2006.

## **2 GENERAL REQUIREMENTS FOR A STRATEGIC RESERVE**

The assignment contained in State Assembly Bill AB2076 is to evaluate the feasibility and costs of a reserve equal to two weeks of production of the largest refinery in California. Based on incidents occurring in recent years, a period of two weeks was considered to be a good order of magnitude fit with observed unplanned outages of refineries in California. For CARB gasoline, two week's worth of the largest individual production by a refinery in the State corresponds approximately to 2.3 million barrels. For CARB diesel and jet fuel, this number is 0.6 million and 0.9 million barrel respectively.

Because of unusable space in tanks (i.e., a tank will have a "heel", the minimum amount of liquid necessary to keep a floating roof from landing on the bottom, and a "freeboard" which is a minimum height to be left at the top), the nominal shell capacity of the tankage will be closer to 2.5 million barrels. Additional requirements for the reserve need to be formulated to ensure that the reserve is adequate to satisfy not just the letter of the Bill, but also the intention of the lawmakers, namely to ensure a certain degree of price stability at reasonable cost.

### **2.1 Requirements for Price Stability**

A more detailed analysis of the effectiveness of a reserve based on two week's capacity of the largest California refinery will be provided in Section 8. However, some general operational requirements for a reserve can be formulated even when assuming that the two week's capacity requirement is a given. For instance, price spikes currently are almost instantaneous reactions in the spot market to supply disruptions that often last only days or weeks. If an unplanned refinery outage occurs at a time when industry inventories are already low, an intervention with volumes drawn from a reserve will have to be quick, i.e., within days rather than weeks, in order to have effect in stabilizing prices.

The need for reserve inventories to be immediately accessible translates into requirements not only for release procedures, but also for the logistics of moving product from the reserves into the markets. Even before conducting a detailed analysis of the reserves interaction with market mechanisms, it can be concluded that in order to bring price stability to a market where prices can move up by as much as 20 cpg on the same day that an announcement is made about a refinery outage, the reserve should have the capability, credible to the marketplace, to deliver product into the market within at the most one or two days at rates comparable to the lost capacity.

## 2.2 Fuel Quality Requirements

Typically, a California producer of gasoline may have to store and blend as many as 6 different qualities of gasoline during each of two separate seasons, a winter season which in most parts of California lasts from November into February, and a summer season which lasts the remainder of the year and is characterized by more stringent vapor pressure requirements. The diversity of gasoline grades, the seasonal changes, and other quality aspects such as the limited shelf life of gasoline in general, impose particular challenges for the eventual creation of a strategic reserve.

Moreover, given the likelihood of imports needed to replenish the reserve after a drawdown of stocks, and the fact that such imports will largely consist of blending components rather than finished products, the reserve will have to be designed in such a way that it offers flexibility in terms of storing various grades of unfinished products and blending components, and the ability to blend final products to customer specifications prior to delivery into the common carrier pipeline grid.

For this reason, it is recommended that tank sizes will be limited to 150,000 bbl, a size generally considered as not too big to store blending components cost effectively, and not too small so that at most two tanks are needed to receive waterborne shipments in full cargo loads. The tanks will have to be designed for multiple product use with drain-dry bottoms. Also, blending and circulation pumps will be highly desirable, as well as a Vapor Destruction Unit (VDU), that will enable collection and incineration of vapors displaced under a floating roof when it is refilled after the tank has been fully drained, with the roof landing on its supports. When considering those alternatives that involve newly built storage, the costs of the above facilities will be taken into account.

Even if the reserve is built as part of larger new storage terminals in which state-sponsored tankage is made available against commercial rates to qualified third parties, i.e., built 5 million barrels of capacity, keep 2.5 million for the reserve and lease the other half to commercial third parties to create a large commingled pool of gasoline and components, it is recommended to augment the number of tanks rather than the tank size. This will allow individual storage for all commonly used blendstocks and components, and will create the operational flexibility to maintain reserve inventories that can be blended to meet the specific requirements of a particular supply disruption.

## 2.3 Logistics Requirements and Site Selection

In determining the best location for the reserve, it is necessary to evaluate the logistics of delivery of fuels from the reserve into the market, as well as those of restocking the reserve

after drawing down inventories. In order for the reserve to effectively compensate for an unplanned outage of a major refinery, it is important that fuels released from the reserve can reach the markets quickly, as concluded under 2.1 above. This translates into infrastructure requirements that will prevent the logistics involved of becoming a bottleneck in itself and still cause price spikes in the market.

Since California effectively consists of two separate markets served individually by the main refining centers in the LA Basin and in the Bay, a single location for the reserve would greatly reduce its effectiveness. In the absence of a pipeline link for products between the Northern and Southern refining centers, a single reserve would only be able to provide immediate relief to the market in which it is located, whereas a significant logistics effort would be required before product could be delivered to the other market. For instance, if a reserve were to be located in the Bay Area, and a supply disruption such as an unplanned outage of a major refinery occurred in the LA Basin, then at least 100 TBD of products would have to be transported over an average distance of approximately 400 miles, for a total transport requirement of 40 million barrel-miles per day.

Very little gasoline moves by rail in California and as a consequence the rail infrastructure in terms of tank cars and handling facilities is incapable of playing any role whatsoever in moving barrels from a reserve to market. Equally, the probability is low of finding and positioning a US flagged product tanker within days, the timeframe required to respond to a refinery outage before prices would be affected, also ruling out this transportation mode as an option. This leaves trucks and barges as the only remaining alternative, but here the issue is whether or not the transport system can mobilize sufficient additional capacity at short notice.

On average, delivery of gasoline to the retail stations involves an estimated 30 million barrel-miles per day of tank truck movements, while shipments of petroleum products and crude oil by coastal barge along the West Coast were 4.6 billion ton-miles<sup>16</sup> in 1999, or approximately 100 million barrel-miles per day. Clean product movements make up approximately one third of this volume. This means that to transport fuels from a reserve location in the Bay Area to LA or vice versa in case of a major refinery outage would require more than doubling daily truck and barge movements. It is not realistic to expect so much transport capacity to be available at short notice (i.e., as spare capacity, not otherwise utilized).

Given these logistical constraints it will be clear that if a reserve is to be created, it will have to consist of at least two separate storage centers, one for each main market. Other locations

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<sup>16</sup> US Maritime Administration, *“Highlights Coastal Tank Barge Market”*, Staff report, May 2001.

may be considered in addition, for instance at the existing staging terminals for the main long distance pipelines. However, if reserve volumes are located further downstream in the distribution system, they should not exceed the demand of the downstream market over the time period to be covered. If larger reserves were to be created further downstream in the distribution system, the volumes in excess of local demand would require reversal of normal distribution flows in order to be of any use, which in most cases is impractical if not impossible.

In general, given the high degree of utilization of the California infrastructure for fuel deliveries (terminals, gathering systems, long distance pipelines, truck, rail and barge fleets), it will vastly increase a reserve's effectiveness if it can be integrated into the refining centers in such a way that in order for the reserve volumes to reach the market, they will use the same logistical assets as the refinery volumes they replace.

Another important logistics consideration in determining suitable locations for a reserve is that of re-supply. Since California is overall short in production capacity for all its fuels, with refineries running at maximum capacity and achieving utilization rates of 95% or more, any lost production due to an outage of a major refinery must either be made up by imports or balanced by reduced demand caused by price increases. Since the latter is the undesired effect the reserve hopes to prevent, it follows that any volumes drawn from the reserve will have to be made up either directly or indirectly by imports, while additionally any short-notice delivery from the reserve must utilize existing infrastructure capabilities. Therefore the logistical requirements for an eventual reserve can be summarized as follows:

- The separate northern and southern California markets will each have to be served by its own reserve.
- The reserves will have to be integrated into the two refining centers in such a way that product from the reserve can be delivered to the market using the existing infrastructure, seamlessly replacing the lost volumes.
- The reserves will have to be provided with deepwater access so that they can be restocked directly with imported products.

The locations that meet these requirements are (i) in the North, the Eastern Bay area within the gathering system connecting the local refineries and commercial terminals with the Kinder Morgan pipeline head in Concord, and (ii) in the LA Basin, the Wilmington/Carson/Watson area with access to all major refineries, and tied into the feeder system for the Kinder Morgan pipelines at Colton. Further downstream, additional storage can be provided at Concord and Colton, or other pipeline hubs.

The problem that arises when locating separate reserves in each of the major refining centers is that of the distribution of the volume. If the requirement for two week's production of the largest refinery is applied to each of the centers, then the LA Basin reserve would have to be 2.2 MM bbl, and the Bay Area reserve 1.7 MM bbl. However, if a first reserve can provide immediate relief to the market in which it is located, volumes from the second reserve can be brought in over time across the distance separating the two markets within the restraints of the available logistical means. For the purpose of further evaluation, it will therefore be assumed that the total volume of all reserves will be kept at two week's capacity of the largest refinery, or 2.2 MM bbl, to be split into 1.3 MM bbl in the LA Basin and 0.9 MM bbl in the Bay Area, volumes that not only correspond to the ratio of gasoline consumption in the respective markets, but also to the ratio of the production capacity of the largest refinery in each center. These volumes would allow approximately one week's of autonomous coverage within each region, which provides adequate time to mobilize logistic resources to utilize reserves stocked in the other region if necessary.

## **2.4 Requirements for Extraordinary Events**

Besides unplanned outages of California's refineries, there are other events that can cause even more severe supply disruptions and price spikes, i.e., earthquakes, acts of terrorism, crude oil supply disruptions resulting from environmental disasters (as was the case after the Exxon Valdez disaster), or geopolitical events such as embargoes and wars. In fact, as will be shown in Section 3 below, most countries that maintain a Strategic Fuel Reserve do so for reasons of national security rather than market stabilization. In such cases, the reserve volumes are much more substantial, i.e., in the range of several months of total consumption rather than two week's capacity of a single refinery.

While the creation of a reserve for reasons of national or State security is not included in the scope of this study, it is relevant to look at the potential value of a reserve in case of an earthquake. Whereas events such as wars and embargoes will have an impact on a national scale that requires very large reserves, the effects of an earthquake tend to be local and previous reserve studies were specifically commissioned to cover this event.

When evaluating the potential value in the event of an earthquake of a smaller reserve designed for commercial market stabilization, it becomes quickly apparent that the locations identified above for logistical reasons render the reserves vulnerable. The East Bay Area and the Watson/Wilmington/Carson area essentially share the same geologically unsound coastal structures as the major Californian refineries, and in that respect, they are not ideal because they too are likely to be affected to some extent by the same quake that might damage one of the refining centers.

Yet, to design a reserve capable of providing adequate coverage of fuel needs in the wake of a major earthquake is not practical and was evaluated in earlier studies as not cost effective. The reserve in that case would have to provide for many weeks of equivalent capacity to not one but likely several major refineries, for events that have a very low probability of happening during the technical and economical lifespan of the reserve.

For extraordinary events, for which the extent of the shortfall and the duration of the outage are likely to require a very large amount of fuels in reserve to mitigate the effects of the outage, but which have a very low probability of ever happening, a better approach than the creation of a reserve is a temporary relaxation of California fuel quality requirements, so that alternative supplies can be brought in from a wide array of supply options outside the State.

### **3 DESCRIPTION OF OTHER STRATEGIC FUEL RESERVES**

National Petroleum Reserves became part of an overall emergency response plan orchestrated by the International Energy Agency (IEA) under the 1974 Agreement on an International Energy Program (EIP) of which the United States is a signatory. Every five years the IEA publishes an exhaustive report on its Member countries' preparations to respond to major oil supply disruptions. Most of the 28 countries maintain oil stocks well above the 90 days of net imports to which they are committed. IEA countries also have viable demand restraint programs and are monitored for weaknesses in their response systems. Those response mechanisms include: stock drawdown, demand restraint, fuels switching, extra oil production and the sharing of oil supplies.<sup>17</sup> Below, several of the domestic and international reserve initiatives will be evaluated in order to see whether experience gained with the creation and operation of these reserves has relevance for the situation in California.

#### **3.1 General Aspects of Strategic Fuel Reserves**

Some of the key aspects of strategic fuel reserves in general are the sizing, inventory management and release mechanisms

##### *3.1.1 Sizing of Strategic Fuel Reserves*

Almost all national SFRs are maintained by countries that are significant net importers of petroleum products, and the size of the inventories is designed to protect these countries from being held hostage by their supplying nations. Usually, such reserves are sized as a function of the total fuels demand of the nation as a whole, with typical quantities of fuels stored ranging from 90 to 120 days.

There are only a few instances where, as would be the case for California, a reserve is designed for price stability. Examples are the Northeast Heating Oil Reserve and the Massachusetts Heating Oil reserve, which were designed to protect their populations against price spikes as well as the physical dangers from running out of heating oil in abnormally cold winters.

There is no known example of a reserve specifically created to counteract supply disruptions caused by internal production problems, although the reserves created in other island economies such as Korea and Japan used to have, will have a somewhat dampening effect on prices, as will be discussed below.

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<sup>17</sup> International Energy Agency website – <http://www.iea.org>

### 3.1.2 *Inventory Management of Reserves*

Many countries store petroleum products in addition to or instead of crude oil as part of their oil stockpiling programs. A broad range of stockholding mechanisms have been adopted by IEA and European Union (EU) members, none of which match the commercial or logistical features of California but are useful to consider as points of reference. There are three primary mechanisms:

- **Government Stocks.** These stocks are owned and controlled by member governments and account for 26 percent of stocks in IEA countries. Germany, Italy, Ireland, Japan and the United States hold government stocks.
- **Agency Stocks.** These stocks are held by agencies created by members for purposes of holding stocks and collaborating between government and industry. Agency stocks are much the same as government stocks, in that they fall under government procedures, are segregated, are of the same quality as government stocks, and are subject to government control. Agency stocks account for 5 percent of stocks in IEA countries.
- **Company Stocks.** These are privately held stocks, which count toward a member's IEA reserve commitment. In 1993, company stocks accounted for 69 percent of stocks in IEA countries. The only IEA member countries that do not impose compulsory stockholding requirements on companies are the two net oil exporters, Canada and Norway, and Australia, the United States and New Zealand. Under this approach, strategic stocks may be held by the oil industry on behalf of the government, usually as a legal requirement. Obligations are calculated and monitored by the government. Strategic stocks are part of or considered alongside operational stocks.<sup>18</sup>

The U.S. opted for a centralized government reserve, rather than the "industrialized petroleum reserve" or agency concept. Advantages of a government reserve are complete control over storage with release and use of stocks under central control with minimum disruption to the oil industry. Disadvantages are high initial set-up costs and administrative and technical burdens to the government. An amalgamated system provides flexibility but makes it difficult for the government to know how much oil is available in an emergency.

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<sup>18</sup> Report to Congress on the Feasibility of Establishing a Heating Oil Component to the Strategic Petroleum Reserve, June 1998, Appendix F.

The U.S. differs from many other IEA countries in its means of financing the Reserve. In contrast to the United States, where the costs of the reserves are borne fully by the Government and financed out of general revenues, in countries such as Japan, Germany, and Italy, the costs are shared by the petroleum industry and the end-user.

Advantages of the agency approach to stockpiling are use of oil industry expertise for management, increased consideration of oil industry interests and flexibility in storage and distribution arrangements. Disadvantages are the high costs to set up such a program unless existing stocks and storage are already available, and the need for arbitration of various industry interests. In the case of a California SFR being adopted, this model had the strongest positive feedback among the stakeholders. Unanimously, the industry did not want to see the government operating a petroleum reserve. An Agency arrangement would be more responsive to California's unique supply, scheduling and pricing environments.

### 3.1.3 *Trigger Mechanisms*

One of the most critical components of any SFR is its trigger mechanism for release of inventory. For most national strategic fuel reserves, the authority to release inventories is vested at high levels in a country's executive branch, under conditions that meet a number of predefined criteria, which are usually so narrowly defined that the existence of the reserve is not really a factor in day-to-day market considerations.

For a reserve whose aim it is to prevent price spikes rather than to be there for national emergencies, a trigger mechanism needs to be broader defined. There is a widespread concern that if this vital element is mismanaged then price spikes could be prolonged rather than remedied. Uncertainty over when SFR inventories might be sold into a tight and rising market could actually inhibit out-of-state suppliers from sending cargoes to California. They would fear that after putting a California-bound cargo on the water, the SFR might dump product, driving down the price and undermining the value of their cargo position. Since there is no futures market in the State, an offshore supplier would be subject to this unintended risk.

The same concern was voiced by a number of participants in the Federal Petroleum Products Reserve (FPPR), during the feasibility assessment phase of the Heating Oil project. Even today, with the FPPR a well-defined and ongoing operation, a number of prominent companies believe that unfettered supply and demand forces are still the best antidotes to skyrocketing prices. They assert that when prices rise sharply, an immediate commercial incentive is created to deliver new supplies into that market

from NW Europe, the Caribbean, from the US Gulf Coast and South America. Technical analysis of the efficacy of the Federal HO trigger mechanism still reveals flaws in the internal logic of that program.<sup>19</sup> *An eventual California reserve must be designed such that its use does not invoke an arbitrary, event driven trigger mechanism that caused importers to withhold shipments.*

### **3.2 Federal Strategic Petroleum Reserve**

The Strategic Petroleum Reserve (SPR) was created in 1975 in the aftermath of the first oil crisis when President Ford signed the Energy Policy and Conservation Act<sup>20</sup> (EPCA42 U.S.C. §6231, et seq.). Several earlier attempts to create a national oil storage reserve during WWII and the Suez Crisis, and lastly by the Cabinet Task Force on Oil Import Control in 1970, all had failed. The SPR was commissioned in 1977 and it still is the largest emergency oil stockpile in the world, with a design capacity of up to 1 billion barrels. Together, the facilities and crude oil represent more than \$20 billion in national investment. The emergency crude oil is stored in caverns created deep within the massive salt deposits that underlie most of the Texas and Louisiana coastline. The caverns offer the best security and are the most affordable means of storage, costing up to 10 times less than aboveground tanks.

The EPCA gives the Department of Energy (DOE) statutory authority to implement the Plan for a Strategic Petroleum Reserve, which is to acquire and operate the storage facilities. Equally, the DOE has the authority to acquire petroleum products for the SPR. The EPCA also authorizes the establishment of Regional Petroleum Reserves (RPR) as part of the SPR, and requires that the SPR Plan provide for the establishment of an RPR for each Federal Energy Administration region that relies on refined product imports for more than twenty percent of its demand.

Finally, the EPCA authorizes the Secretary of Energy to establish an Industrial Petroleum Reserve, which is defined as that part of the SPR consisting of petroleum products owned by importers or refiners (rather than owned by the Federal Government), and grants the Secretary discretionary authority to require refiners and importers of petroleum products to maintain readily available inventories equal to three percent of the previous years' throughput or imports.

The volumes of the SPR may only be used when the President determines that implementation of the Distribution Plan foreseen by the EPCA is required by a "severe energy supply interruption or by obligations of the U. S. under the international energy program", i.e., when

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<sup>19</sup> PIRA report

<sup>20</sup> DOE Fossil Energy – Strategic Petroleum Reserve: Website – [http://www.fe.doe.gov/spr/spr\\_facts.shtml](http://www.fe.doe.gov/spr/spr_facts.shtml)

the President determines that there is a significant reduction in supply, causing such a severe increase in the price of petroleum products that it is likely to cause a major adverse impact on the national economy.

Two exceptions permit sales from the SPR without a Presidential declaration under the emergency conditions, either as test sales in amounts not to exceed 5,000,000 barrels, or in amounts not to exceed 30 million barrels in total or for more than 60 days, both under narrowly defined conditions.

**Relevance for California:** The relevance of the EPCA for an eventual California Fuels Reserve lies in the federally mandated requirement for the creation of a Regional Strategic Petroleum Product Reserve for regions that are dependent on imports for more than 20% of their fuel requirements. California's foreign imports currently amount to approximately 25% of its crude and 15% of its petroleum products, percentages that are both expected to increase significantly. Thus, if the State were to constitute a region in its own right, it would have to create reserve for crude now and one for products in the not too distant future.

### 3.3 Northeast Heating Oil Reserve

The Northeast Heating Oil Reserve (NHOR) was created as a Regional Petroleum Product Reserve (RPPR) under EPCA, at the initiative in 1996 of several Members of Congress who were concerned that low inventory levels of heating oil might cause severe price spikes or outages in case of a severe winter<sup>21</sup>.

The basic volume requirement for the reserve was set by estimated heating oil consumption in the Northeast during a severe winter, with a duration and with temperatures that can be expected to occur only once every 100 years, based on the statistic evidence of meteorological data collected for the region since the middle of the 19<sup>th</sup> century, which happened to correspond to conditions that prevailed in 1989. This calculation resulted in a volume requirement of 6 million barrels, but since only 2 million barrels could be placed in existing terminals in the Northeast itself, it was decided to limit the regional reserve to this volume, while provisions such as a waiver of the Jones Act would enable quick re-supplies from other inventories available in the SPR caverns in the Gulf Coast.

Three private companies were selected to store and manage the NHOR in leased storage at three terminals, located in New Haven, CT and Woodbridge, NJ. The reserve is commingled with commercial volumes in active tanks to avoid quality problems with aging inventories. Also,

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<sup>21</sup> Department of Energy, *Heating Oil Component to the Strategic Fuel Reserve*, Report to Congress, June 1998

the commercial operators are occasionally allowed to dip into the reserve volumes with prior approval of the DOE.

The Northeast Heating Oil Reserve has special relevance for this study because it is one of the few examples of a reserve created specifically to provide price stability, rather than for reasons of national security. Moreover, the reserve was designed to meet certain criteria of cost effectiveness, and the methodology used in the study that justified its creation was based on sophisticated statistical evaluations.

During stakeholder survey meetings (see section 9), the issue was raised with companies that market fuel oil on the East Coast, and several meetings were dedicated specifically to this subject. The conclusion from these discussion is that, even though the reserve has not yet been put to the test of the once in a 100-year winter for which it was designed, the reserve is not expected to be effective in the opinion of the industry involved in the heating oil business in the region. The perceived shortfalls are:

- The 2 million barrels of reserves equate to only three days of average winter demand in the Northeast, less than two days in case of peak demand during a cold snap.
- The reserve occupies existing tankage that was well used by the industry and usually would be kept full at the onset of the winter heating season anyway (this argument was addressed in the heating oil study and was one of the reasons for only using up 2 million barrels of space).

**Relevance for California:** Because the Northeastern Heating Oil Reserve is one of the few reserves specifically designed to mitigate price volatility, and was executed within similar size tankage as would be the case for a California SFR, this reserve merits a more detailed comparison. In table 3.1 below, a comparison is made between the various factors that together constitute the framework for requirements and effectiveness for a Regional Petroleum Product Reserve.

From the comparison below, it will be clear that the requirements for an eventual California Strategic Fuels Reserve are far more complex but also more urgent than those of the Heating Oil Reserve in the Northeast. It would seem that if a reserve for heating oil in the Northeast could be justified on economic grounds, then a gasoline reserve in California could also be warranted by an economic justification. In this context it is interesting to note that the inventories for the Northeastern Heating Oil were in part funded at federal level by selling off equivalent quantities of crude oil from the Federal Reserve.

Table 3.1 – Northeast Heating Oil Versus CA Gasoline Reserve

	Northeast HO*	CA Gasoline
<b>Demand</b>	0.7 MM BPD winter average	1.0 MM BPD year round
<b>Available Inventory Range</b>	20 to 60 MM bbl = 40 MM bbl	18 – 10 MM bbl = 8 MM bbl
<b>Effective days inventory</b>	70 days av. winter demand	8 days regular demand
<b>Product Fungibility</b>	Readily fungible	Unique to CA
<b>Product Grades</b>	One	Multiple Summer and Winter
<b>Blending restrictions</b>	None	Unocal Patent, CARB cert.
<b>Market Liquidity</b>	1000+ trades/day	<20 trades/day
<b>Futures Market</b>	Broad, up to 1 year deep	Narrow, next month only
<b>Market participants</b>	Large Community	Closed Market
<b>Pricing</b>	Transparent	Limited reporting
<b>Demand</b>	Seasonal Only	Year Round
<b>Import options</b>	100s of refineries worldwide	3 – 5 refineries
<b>Shipping time</b>	1 – 2 weeks	5 – 8 weeks
<b>Import terminals</b>	68 in 26 ports	16 in 2 ports (incl. refineries)
<b>% of Population Affected</b>	11% (54% in Maine)	>90%

\* basis: 1996 DOE Study

### 3.4 Massachusetts

Shortly after the initiation of the Federal Heating Oil Reserve, the State of Massachusetts adopted a somewhat different program to ensure adequate supplies for the state through the winter of 2000, 2001.<sup>22</sup> Discussions with consultants involved in crafting the alternative plan, and review of the provisions of the actual program adopted, reveal a deliberate departure from the “hold, auction and sell” philosophy that underpins the two million barrel Federal Reserve described above. The view was that incentives could be offered to private sector companies to hold certain minimum target inventories through the potentially high-demand months of

<sup>22</sup> Commonwealth of Massachusetts Office of Consumer Affairs and Business Regulation – Heating Oil Inventory Program, A Report by the Division of Energy Resources, March 2001

December through March. The supply, demand and general market pricing factors that compelled the Governor of Massachusetts to urge the Legislature to fund an emergency inventory program were these:

- Heating oil inventories were at historic low levels and only about one-fourth the level at the start of the previous heating season.
- Crude oil prices were extremely high and there was uncertainty if they would increase or drop.
- In October, Massachusetts retail heating oil prices were 50% higher than the previous year.
- Increases in world crude oil production would not eliminate heating oil market vulnerability.
- The market was in 'backwardation' (a term used when prices in future markets are below the prompt market) and Massachusetts heating oil suppliers did not want to store heating oil if they might lose money.
- Cold to colder-than-normal temperatures would also lead to price spikes and increases in consumer heating bills.

**Innovative Program:** Rather than the State leasing storage and holding inventory, the program establishes a price insurance program for winning bidders that takes the backwardation out of the market for the key months. Essentially, the winning bidders were expected to purchase and store a minimum block, or 10,000 barrels of heating oil. The bidder could submit bids for one or more blocks, and had to specify a bid price and specific storage location for each block. Winning bidders were required to hold the oil until January 16, 2000. Thereafter, the winning bidders could release the oil for sale to Massachusetts's consumers. The decision to release oil before the program date was left to the winning bidders. If the market dictated a need for oil, and winning bidders decided to use the program oil, winning bidders could sell the oil before the program end date (early release). Notification of an early release had to be provided to DOER on the date of the early release. Because early release of program inventory was contrary to the goals of the program, an adjustment would be made to reduce the payment to a winning bidder that executed an early release. The payment adjustment provided an incentive to winning bidders to store the oil until the program end date.

A review of the success of the program after the winter showed:

- Heating oil inventory levels were higher than expected despite colder weather.
- Wholesale prices in Massachusetts were 2-3 cents lower than in surrounding states.
- Massachusetts' retail heating oil prices remained around \$1.50 per gallon in December and January with no price spikes even though the weather was about 10% colder than normal.

The entire scope of the program is described in detail on the Massachusetts Energy Website<sup>23</sup>.

**Relevance for California:** Storage for heating oil by winning bidders under the Massachusetts program is distributed in independent terminals around the State. In California, there is no such distributive storage in the hands of independents. As will be shown in Section 4 below, inventory capacity for fuels in California is extremely tight already. Consequently, an incentive program such as that adopted by the State of Massachusetts is not practical in California. It should be kept in mind however, that if the SFR initiative leads to new tankage being built, then a Massachusetts style incentive program might have to be revisited.

### 3.5 European Reserves

The fundamental purpose that underlies all European and IEA Strategic Reserves is that of national emergency and supply interruption preparedness, with systems designed and maintained for major events such as wars, sabotage, and natural disasters. The Reserves are part of a more comprehensive emergency civil response plan under which the EU requires its members to hold emergency stocks of oil products for three major categories (gasoline and related feedstocks, middle distillates, and heavy fuel oil) equivalent to 90 days domestic consumption of the previous year. The level of 90 days must be maintained for each category. Members may substitute crude oil for product stocks, but the crude oil and feedstocks are converted into finished product equivalents in the three categories for purposes of meeting the EU requirements.

The European systems range from distributive stocks held by the private sector but under government supervision in Italy, to complex mechanisms that have evolved over time in countries as diverse as France and the Netherlands. In Germany, Italy and Ireland, the government owns the Strategic Reserves. Denmark, France and the Netherlands hold agency stocks, with some agencies established under pressure from the industry rather than by government on its own accord.

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<sup>23</sup> Massachusetts Department of Energy Website: <http://www.state.ma.us>

**Relevance for California:** Most European countries store their reserves in large volumes kept outside the normal distribution channels, in salt dome caverns (Germany, France) or in cavities excavated in granite and other hard rocks (Scandinavia), or in extensive aboveground tank farms (The Netherlands). Because for the most part, the European reserves are not operational, the inventories need to be periodically rotated to prevent product degradation. For many years, for example, straight run (non cracked) gasoline was held in tank without rotation in the Netherlands. After a change of specs was introduced and various streams of cracked hydrocarbons entered the gasoline pool, the reserves had to be commingled with industry stocks for rotation purposes. The turning of large volumes of old inventory created artificial price collapses and volatility, a lesson to be learned for California.

Because the release mechanisms for the European product reserves are designed for exceptional circumstances only, the presence of very large reserves does not affect normal market mechanisms in terms of supply and demand, with its associated volatility, other than the impact from the occasional stock rollovers for reasons of quality control.

### 3.6 Japan

Japan has a history of oil stockpiling going back to 1972 after the first oil shock, when the government introduced the “Petroleum Reserve Law” creating a 60 day reserve supply, which was increased to 90 days in 1976 and relaxed in April 1996 to 70 days. These requirements apply to all producers and importers, and to crude oil as well as to refined products, with quantities based on actual import levels for the preceding twelve months.

The change in 1996 was part of a deregulation effort when the country repealed a law that restricted imports. Since then, non-refiners are allowed to import gasoline, diesel and kerosene into Japan, so long as they maintain a rolling inventory that complies with the Law<sup>24</sup>. The idea behind this policy is that some level of reserves must be maintained for emergency situations, but in normal times the competition on the international petroleum markets should prevail, even in Japan.

**Relevance for California:** The parallel with California is that for petroleum products, both are de facto island economies. But while Japan is moving away from its self imposed isolation by opening its markets for imports while maintaining certain minimum reserve requirements, California has been moving the opposite way when it imposed unique fuel specifications and

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<sup>24</sup> Petroleum Association of Japan: <http://www.paj.gr.jp> Annual Report “Overview of the Japanese Petroleum Industry”

lost import infrastructure assets in the ports. The market lessons from Japan will be discussed in more detail in Section 7.

### 3.7 Korea

In South Korea, the Minister of Commerce, Industry and Energy has wide ranging powers under the “Petroleum Business Act”<sup>25</sup>, which grants rights to set the target amount for petroleum reserve not just for major events but also for price stabilization and control of the petroleum markets. It is important to note that Korea has some of the largest refineries in the world with capacities at LG Caltex, Yosu and Yukong (SK) in Ulsan, each in the range of 800 to 900 TBPD. Refinery capacity is overbuilt and geared toward export markets. Consequently the Korean Strategic Reserve has been set aside for crude oil rather than petroleum products.

**Relevance for California:** Because the markets for petroleum products in Korea is only just now starting a process of deregulation with import opportunities opening up and arbitrage pricing mechanisms linking these markets to world supply and demand, it is too early to tell whether or not the presence of the reserves and the way in which the reserves were managed, had any stabilizing effect on pricing, or caused imbalances between natural supply and demand.

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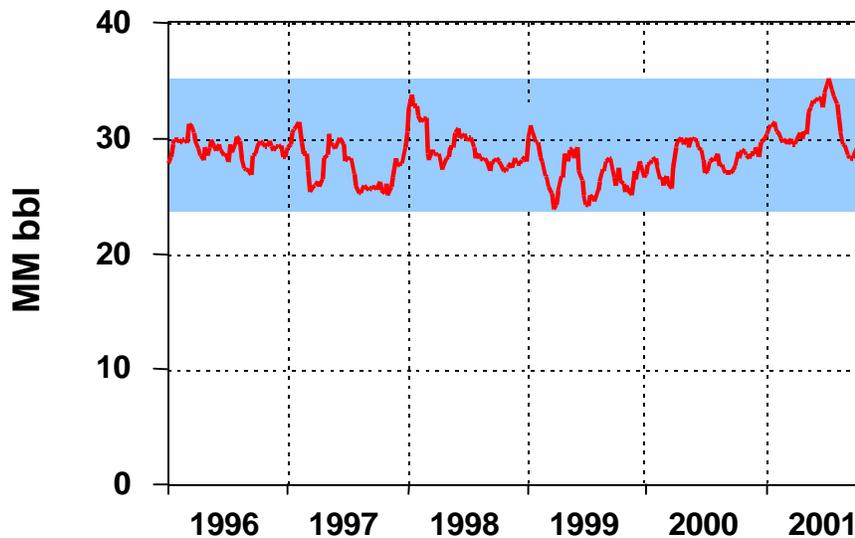
<sup>25</sup> Korea’s Petroleum Business Act – Article 15; <http://www.petronet.org/english/law/pact.htm>

#### 4 OVERVIEW OF INVENTORY CAPACITY AND USAGE

Besides the refiners, several traders and some of the larger buyers currently maintain their own inventories of fuels in California. The refiners also retain title to most of the products in the downstream distribution system, i.e., product in transit in pipelines and kept in distribution terminals.

The refiners and some of the terminals report their inventories on a weekly basis to the EIA and to the CEC. Unfortunately, most refiners consolidate their numbers for PADD V and do not separately report data by state.

Figure 4.1 – Weekly Reported Total Gasoline and Components PADD V



As can be seen in Figure 4.1, the total reported PADD V gasoline and blendstock inventories move in a fairly narrow band around 30 million barrels. When inventories fall below 27 million bbl, the market begins to anticipate shortages and product in general will be hard to find. When inventories start to climb over 30 million barrel, spot prices will be reduced until refinery runs are cut.

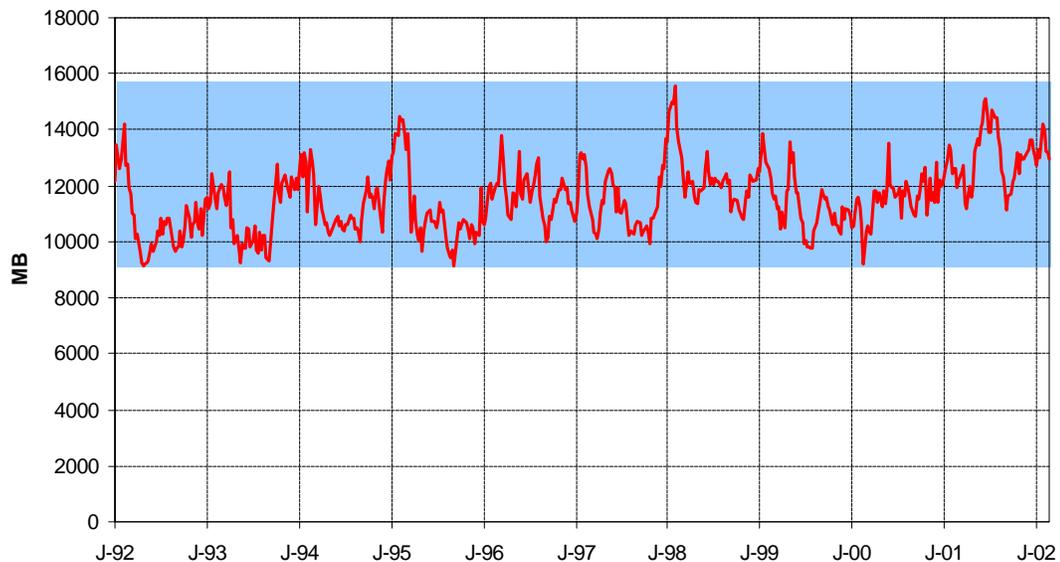
The industry therefore attaches great importance to these inventory numbers as they are reported on a weekly basis, notably to determine whether the market is long or short, i.e., what the short-term trend in the supply/demand balance is. Yet it is generally not well understood how these inventories are distributed between the States, or between the various parts of the distribution chain. Nor is it well understood what the total holding capacity was in the distinct northern and southern California markets, and how the industry manages inventory levels. Moreover, the current reporting system to the CEC does not capture all inventories held in the system. Yet to evaluate the effectiveness of a potential Strategic Fuels Reserve, the total current inventory capability in the State must be known, and current operational aspects must be understood. This Section addresses these questions.

Another interesting observation around Figure 4.1 is that of the narrowness of the range in proportion to the absolute inventory levels. The explanation is that the total number of tanks included in the PADD V inventory numbers is in excess of one thousand. Inventories in most of these tanks are driven by operational reasons, i.e., inventories in distribution tanks or tanks at refineries will cycle between full and empty on a regular periodic basis, sometimes as frequent as several times per week, with the time-weighted average equal to 50% of the workable range. The sum of a large number of such inventories will narrowly approach the average.

#### 4.1 Refinery Inventory Capacity

California refinery inventory data are collected separately by the CEC. These inventories as reported also include certain inventories held at commercial terminals in the Bay area, but not in the LA Basin, and are shown in Figure 4.2.

Figure 4.2 – CA Refinery Inventories of Gasoline and Components <sup>26</sup>



As can be seen in Figure 4.2, gasoline and component inventories held at the California refineries move within a range of 8 to 16 million barrels. The total shell barrel capacity for tanks at the refineries dedicated to gasoline and gasoline components is approximately 13.3 million barrels for the Bay area refineries and 13.7 million barrels in the LA basin <sup>27</sup>. At their highest historical reported level, actual inventories represented therefore approximately 60% of the total available shell capacity, and at their lowest 30%. This percentage confirms that most

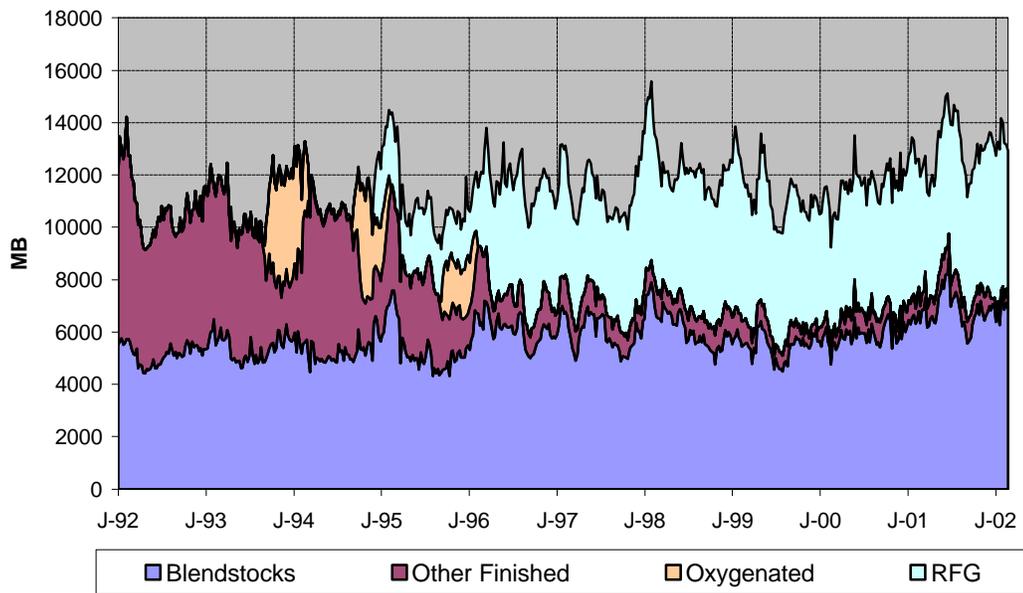
<sup>26</sup> CEC Weekly Reported Inventory Data

<sup>27</sup> Based on information received during the Survey Meetings conducted for this Study

refiners cannot use the tankage at their refineries as an internal reserve for strategic purpose or market tactics, but that operational considerations determine how tankage gets used, with most tanks cycling between full and empty as production is run down into tanks before a batch is pumped out on a pipeline.

For instance, in 1999 when prices were high at the time when major refinery outages occurred, refiners would have had every incentive to use available inventories to the maximum extent possible. That actual inventories never dipped below 8 million barrels confirms that this level represents a collective operational “heel”, the minimum stock of blendstocks and finished products that is needed to maintain operations.

Figure 4.3 – Breakdown of CA Refinery Gasoline & Blendstock Inventories <sup>28</sup>



As can be seen in Figure 4.3, blendstock components, including oxygenates, make up over half of the total reported inventories at any point in time. Also noteworthy is that although Other Finished Gasoline constitutes only a small fraction of total inventories, supplying two distinct types of gasoline means that some tankage each in different octane grades, means an inherently less efficient use of tankage.

## 4.2 Commercial Terminals

Most of the capacity in commercial bulk liquid petroleum terminals in California is concentrated in the Bay Area and in the Los Angeles Basin, where several commercial storage companies

<sup>28</sup> CEC Weekly Reported Refinery Inventories

operate facilities, most of which are tied in to deepwater berths as well as the refinery pipeline infrastructure. In addition to the commercial terminals, there are a few terminals owned by the refiners that provide commercial services to third parties if capacity allows.

Table 4.1 – LA Basin & Bay Area Commercial Petroleum Terminal Capacity<sup>29</sup>

	MM bbl	Total Tank Capacity	Clean Product Tanks	Gasoline & Components
<b>Bay Area</b>				
Commercial Operator		8.5	5.7	3.8
Owned by Refiner		<u>0.6</u>	<u>0.6</u>	<u>0.6</u>
<b>Total</b>		<b>9.1</b>	<b>6.3</b>	<b>4.4</b>
<b>LA Basin</b>				
Commercial Operator		22.0	5.7	4.6
Owned by Refiner		<u>7.7</u>	<u>7.2</u>	<u>6.8</u>
<b>Total</b>		<b>29.7</b>	<b>12.9</b>	<b>11.4</b>
<b>Total</b>		<b>38.8</b>	<b>19.2</b>	<b>15.8</b>

Within clean product tankage, terminals cannot change service easily from gasoline to distillates unless the tanks are relatively new and designed as “drain/dry” tankage. On average, market information indicates that at any point in time, approximately 80% of tanks permitted for clean products at the major commercial terminals are in service for gasoline or blending components, including oxygenates.

It is important to note how in Southern California, refiners own the majority of the commercial storage for clean products. This is a legacy of two events, the closure of a refinery with tankage being retained as terminal, and the discontinuation of ANS pipeline exports, which freed up storage at the head of the pipeline. In both cases the refiners decided to monetize these assets by making them available to third parties in commercial service. Now that the LA storage market has grown very tight, while for these refiners internal demand for tankage has grown, this storage increasingly is only available to third parties when the refiner’s own operations allow. Moreover, most of the storage at the commercial terminals is leased out to refiners under long-term contracts, because commercial operators prefer the security of longer-term agreements with highly creditworthy customers over potentially higher rates from short term agreements with trading companies or importers.

<sup>29</sup> Sources: OPIS Petroleum Terminal Handbook, ILTA Handbook, and Survey Meetings with Stakeholders

### 4.3 Distribution Terminals

Besides the inventories kept at the refineries and in the main commercial terminals, most integrated producers and marketers of gasoline maintain inventories of finished gasoline in the distribution system. Typically, these distribution terminals are connected to the main pipelines, and the facilities include loading racks to serve local distribution by tank truck to retail stations or large consumers. In addition, the pipeline operators maintain storage at strategic locations along the pipeline to serve their own operational requirements as well as customers' needs for distribution tankage.

Table 4.2 – CA Tank Capacity at Distribution Terminals<sup>30</sup>

	MM bbl	Total Tank Capacity	Clean Product Tanks	Gasoline & Components
<b>Northern California</b>				
Commercial Operator		3.3	3.0	2.4
Owned by Refiner		<u>3.5</u>	<u>3.2</u>	<u>2.6</u>
<b>Total</b>		<b>6.8</b>	<b>6.2</b>	<b>5.0</b>
<b>Central California</b>				
Commercial Operator		0.6	0.6	0.5
Owned by Refiner		<u>0.1</u>	<u>0.1</u>	<u>0.1</u>
<b>Total</b>		<b>0.7</b>	<b>0.7</b>	<b>0.6</b>
<b>Southern California</b>				
Commercial Operator		2.2	2.2	1.8
Owned by Refiner		<u>4.6</u>	<u>4.5</u>	<u>3.6</u>
<b>Total</b>		<b>6.8</b>	<b>6.7</b>	<b>5.4</b>
<b>Total</b>		<b>14.3</b>	<b>13.6</b>	<b>11.0</b>

Again, within the total clean product tankage available, it is assumed that at any given point in time, approximately 80% is in gasoline service.

### 4.4 Pipeline Inventories

Long distance transportation pipelines for petroleum products will hold considerable volumes of distillates and gasoline that are in transit. For instance, a 300-mile long, 16" diameter pipeline will hold approximately 400,000 bbl of product, typically consisting of two or three sequential batches of diesel, jet fuel and gasoline.

Pipeline inventories are sometimes included in reported stocks, but overall, total gasoline hold-up at any given time is likely to be less than one million barrels. This volume cannot be readily manipulated to play a role in working inventories in times of shortages and price spikes,

<sup>30</sup> Source: OPIS Petroleum Terminal Handbook, ILTA Handbook, and Survey Meetings with Stakeholders.

although in theory, temporary substitution of batches of gasoline by other products might free up gasoline at the head of the pipeline. In practice however, given the limited storage for diesel and jet along the system in comparison with gasoline and the time, cost, and undesired operational consequences of changing tanks in service, pipeline inventories are not a factor in the total consideration of workable ranges for gasoline inventories in the State, and will not be taken into account here.

#### **4.5 Reconciliation of Reported Inventories and Total Storage Capacity**

The total storage capacity of tanks in service in California for gasoline and blendstocks appears to be around 53 million barrels, of which 26 are within the refineries, 16 million are at commercial terminals, and 11 million barrels are spread throughout the State at distribution terminals.

Reported actual inventories for PADD V on the other hand cycle between 25 and 35 million barrels. If inventories are assumed to be distributed in proportion to gasoline production and consumption, then California's share of these reported inventories would be around 70% of the total PADD V numbers, or between 18 and 25 million barrels. These numbers are low in comparison with the total shell capacity of 53 million barrels for all identified gasoline storage in California. However, a number of factors need to be taken into account when comparing reported actual inventories with total shell barrel capacity:

- Published industry tankage capacities are mostly based on nominal shell barrel capacity. Most tanks in gasoline service are of a floating roof design. To minimize the vapors that would be displaced by a rising liquid level under a fixed roof and thus cause hydrocarbon emissions, such tanks have a roof that floats on the surface of the liquid by means of pontoons, with specially designed seals between the shell and the roof edge that prevent the escaping vapors to cause emissions. The roofs have legs that will support it on the bottom when liquid levels drop to a minimum, in order to protect the pontoons and to keep the roof structure above other tank internals, such as suction lines or mixers. In normal operations however, the roof has to be kept afloat, which means that floating roof tanks cannot use the lower 5 to 10% of their shell height. On a statewide basis, this represents 3 to 5 million barrels of unusable capacity.
  
- Under applicable industry standards (API 653) tanks in gasoline service are required to be inspected on a 10-yearly cycle, although some operators will extend inspection intervals longer. Given the average duration of such inspection, which is often used to upgrade or modify tanks at the same time, as well as outages for operational reasons such as grade changes, up to 5% of the available storage can be expected to be out of

service at any given point in time. This effectively removes 3 million barrels of listed capacity.

Most operational tankage in gasoline service sees heavy use and will cycle between full and empty on a continuous basis, with some of the tanks being turned over more than once a week. Other operational considerations also cause average inventories to be around half of the total available range:

- In the production process, enough empty tank space has to be available to allow continued rundown, even if a downstream process fails. Buffer tanks between processes that produce gasoline components and the final blending tanks cannot be kept full, but will typically be run between 40 and 60% of their capacity, to allow upside as well as downside swings.
- In the distribution chain, the same barrel passes through many tanks in a sequential process whereby each tank cycles between full and empty, with the average over a prolonged period being close to 50%. For instance, a blending tank in which a batch is prepared for pipeline dispatch will be empty, or only contain a minimum heel, before the batch is prepared. Once blended, the batch is pumped out to on a pipeline, where an empty tank must be awaiting it at the other end. To have all three tanks in the chain being full would result in an un-operable situation.
- Gasoline tankage is fragmented over as many as two-dozen components and blendstocks and for some refiners up to nine grades of final products. This fragmentation inherently causes tank space to be used less efficiently. For instance, a tank in service for a high octane blending component maybe almost empty, but will not help in storing rundown of treated naphtha.

Based on the above assumptions, it is now possible to reconcile the overall tank capacity for gasoline and blending components in California with the reported inventories for the State:

Nominal Tank Capacity California	53 MM bbl
Ullage, heels, non-operable capacity, 15%	<u>- 8 MM bbl</u>
Effective Total Capacity	45 MM bbl
Expected Average Inventory, 50%	22 MM bbl
Expected Average for CA as 70% of PADD V	21 MM bbl

Similarly, storage capacity and reported inventory numbers at California refineries can be reconciled:

Nominal Tank Capacity Refineries	26 MM bbl
Ullage, heels, non-operable capacity, 15%	<u>- 4 MM bbl</u>
Effective Total Capacity	22 MM bbl
Expected Average Inventory, 50%	11 MM bbl
Reported Average Inventory	12 MM bbl

Overall, despite apparent discrepancies, reported inventories can be reconciled with installed shell capacities. Some interesting conclusions now present themselves when looking at these inventory numbers:

- Inventories at refineries and in the distribution system are almost entirely determined by operational considerations, with tanks cycling continuously between their minimum and maximum practical inventory limits, averaging a little less than 50% of shell capacity.
- The only storage capacity that could be used to serve inventory strategies is that contained in commercial terminals, but total capacity is limited and is largely owned by or contracted out to the refiners.

#### 4.6 Inventory Planning

Inventory planning is different of each group of inventory holders, refiners, traders and large jobbers:

- The refiners balance financial, operational and commercial requirements. On the one hand, they would like to minimize inventories in order to reduce the costs of working capital, while on the other hand they have to resort to very costly measures when they are threatened running out of product. Operational flexibility demands that they leave themselves sufficient room to operate, both on the upside and the downside.
- Unlike refiners, traders usually do not own their tankage, but lease it from commercial service providers. The predominant operational requirement for most traders is that the size of the storage is determined by the cargo sizes of vessels. Traders sometimes want to hold on to inventory until market conditions are favorable to a sale. Often the costs of renting storage and the working capital costs are lesser considerations than the gain or loss on the cargo traded.
- The jobbers who maintain fuel inventories do so in order to reduce their vulnerability to market volatility. They have to offset the cost of working capital and rented storage against the advantage of being able to buy when prices are low, and to stay out of the market when supplies are tight.

Since the refiners control by far the largest inventories, and as producers and importers control the volume swings that are to a large extent the cause of market volatility, a more detailed analysis is provided below of factors that impact refinery inventory management.

#### *4.6.1 Inventory Management for Planned Outages*

An oil refinery is made up of a number of processing units that require routine maintenance, such as inspection and repairs, catalyst replacement or regeneration, or upgrading for new technology and replacement of equipment that has reached the end of its service life. A process unit that is down for maintenance is said to be in turnaround. The turnaround cycle for each unit can vary from as little as three months to as long as four years depending on permitting requirements, severity of operating conditions, market conditions, unit performance, and the like.

Normally the maintenance on the units is grouped together such that a number of units are in turnaround simultaneously. A major turnaround typically occurs every three to four years when a refiner brings down its crude unit, catalytic cat cracker, hydrocracker, and/or coker. The duration of a major turnaround normally is 30 to 40 days, although the planning may have started eighteen months earlier.

The turnaround timing and duration are established well in advance. Refiners time their turnarounds so that they occur during the slack demand season. In California the major turnaround season occurs in the period January through March so that the refineries are back in operation for the summer's peak gasoline demand. A secondary turnaround season happens in October/November, after the peak demand.

Refiners do not coordinate the timing of turnarounds with one another, due to anti-trust concerns, but they do track one another's activities. Maintenance contractors frequently have to fulfill a role of go-between and coordinate the refiners' operations because their people and equipment will be at work in a number of refineries at the same time.

The impact of the turnaround on the refinery's fuel production is forecasted and managers responsible for supply and planning are charged with ensuring that sufficient fuel supplies are arranged to meet the refinery's demand forecasts, usually through pre-staging inventories through increased own production, purchases from other refiners or traders, or imports. Rented storage may be arranged when available, and external supplies are scheduled to be delivered through the refinery's own systems during the turnaround.

Generally, planned turnaround coverage does not create price spikes. The coverage is well planned and spaced out. A recent example was seen in the Los Angeles market during the spring of 2001 when a major refiner had an FCC turnaround. The Fluidic Catalytic Cracker (FCC) is the biggest producer of regular gasoline in most refineries. Industry publications reported that the refiner brought its FCC down suddenly, which normally means that the market will spike up as the refiner's traders scramble to cover the unplanned shortfall. In this case the market showed little reaction because the FCC went down on a planned turnaround, for which the refiner's Supply Department had planned adequate coverage, so that they did not have to go into the market at the last minute to cover demand <sup>31</sup>.

Prices frequently will rise if the turnaround is extended past the scheduled completion date and the refiner's traders have to go into the spot market to cover the additional supply shortfall. One can observe, for example, that prices frequently rise in late March or early April as refineries are struggling to complete their maintenance.

#### *4.6.2 Inventory Planning Processes*

The planning processes can be thought of in three different time horizons. These are strategic, tactical, and operational. Strategic inventory planning is long range, one year or greater, and is normally done for the purpose of financial modeling by central corporate planning departments. At this level, turnaround planning is coordinated between a company's different refineries, and the basis is provided for long-term crude oil and feedstock supply contracts, tanker fleet charters, and other long-term commitments. At this stage, inventory targets are set as a function of overall working capital costs and as financial targets for management to achieve.

Tactical planning for inventory is usually the purview of middle management and generally covers the current month and out three to six months. It covers actual volume planning around turnarounds, crude runs, and expected market movements, such as those caused by seasonal specification changes. At this level, planning involves optimization using Linear Programming (LP) models of the refineries.

Operational inventory management is the responsibility of schedulers and occurs in the current timeframe, from right now to out six weeks or the duration of the scheduler's time horizon. It is the scheduler's job to keep product moving out of the refinery to the

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<sup>31</sup> Information received during Stakeholder Meetings.

terminals to ensure that customer demand is met. At this stage, an actual forecast is made showing inventories for each tank, based on production and blending operations, ship and barge movements, pipeline cycles and demand forecasts.

#### *4.6.3 Reactions to Unplanned Supply Reductions*

With most refiners, the Supply Department is not located in the refinery. Therefore, it may take the Supply Department some time to discover that their refinery has had an unplanned supply disruption. Supply disruptions could be as dramatic as a refinery explosion or as subtle as the loss of the pump that delivers product to the pipeline.

When a supply disruption occurs, the refiner's supply department will try to cover their requirements quickly and in such a way as to minimize the impact of the disruption on its own financial bottom line. This implies that if the disruption is not immediately apparent to the public, as is the case for most outages that do not involve a fire or explosion, the refiner will keep a tight lid on information related to its operational difficulties, and go into the market through parallel channels, either directly with its own traders approaching other refiners, or indirectly through multiple brokers and traders, in order to cover its shortfall before a market run-up occurs.

Eventually, the refiner's problems will become known in the market and, depending on the total inventory situation, this news will usually result in a price spike.

## 5 GOVERNMENT ISSUES

There are a number of current regulatory initiatives in the State of California that will negatively impact the supply capability of the petroleum industry in the State, either temporarily or permanently. This section will attempt to quantify the impact of each of these initiatives and their relevance for the creation of an eventual Strategic Fuels Reserve.

### 5.1 CARB Phase III and MTBE Phase Out

On February 19, 2002, a public workshop was held by the CEC to discuss the impact of the phase out of MTBE by year-end 2002, as mandated by the Governor's Executive Order of 1999. The conclusions of a separate study by Stillwater Associates were discussed at this workshop. The scope of this study was limited to the impact of the phase out on gasoline supplies and infrastructure, and the main conclusions of the report are no different than the points raised in the supply and demand section of the Strategic Reserve Study:

- Phase out by year-end 2002 will cause a 5 – 10% reduction in supply. The bulk of the supply shortfall occurs in the LA Basin. If left unfilled, such shortfall is likely to cause a 50 to 100% increase in prices.
- There are no suitable substitutes available from the US Gulf Coast, and even if there were, US flagged shipping would not be available in sufficient numbers.
- Sources for suitable blending components can be identified abroad, but given the currently already constrained import logistics, it is inevitable that the already severe pricing volatility will be aggravated.
- The economic impact of the initial price spike and the subsequent increased volatility were estimated to cost the California gasoline consumer between \$1 and 3 billion per year.
- The recommendation was to delay phase out of MTBE by three years, until additional infrastructure for imports can be realized, and exports to Arizona can be kept within the State as pipeline supplies from the US Gulf Coast reach Phoenix.

As far as the actual scope of the study was concerned, comments during the workshop centered on the economic assumptions, projections of production capacity in the State, and impact of price spikes. Comments outside the scope mainly focused on the adequacy of ethanol supplies, and various environmental issues with viewpoints largely depending on the particular interest of the party.

The result of the various reports and briefings has been that the Governor will take a decision on the proposed delay in the course of April.

## **5.2 AQMD 1178**

As part of a consent decree that resulted from the settlement of a lawsuit brought against the South Coast Air Quality Management District (SCAQMD) by several environmental organizations, the SCAQMD agreed to create new regulations that will result in further reductions in emissions of Volatile Organic Compounds (VOCs) in the Los Angeles basin by 8 short tons per year (8 TPY).

Of these target emission reductions, a total of 3 TPY are to be achieved in three consecutive phases through additional control measures in large-scale petroleum and petrochemical industrial installations. After an initial evaluation of the options, the SCAQMD decided that in the first phase, between 1 and 1.5 TPY of VOC reductions could be achieved by measures that will reduce evaporative emissions from bulk liquid storage tanks. The proposed measures included improving the tightness of roof fittings and constructing domed roof over open floating roof storage tanks containing high vapor pressure petroleum products. Subsequently, the SCAQMD instigated a workgroup with participants from the affected industries in order to discuss feasibility, cost effectiveness and implementation schedules for the proposed regulation.

The new regulation as proposed by the SCAQMD, which initially was referred to as Rule 1173.1 and later designated Rule 1178, called for doming of all crude oil and product tanks at facilities with total VOC emissions greater than 20 TPY, under a program of which the first phase, comprising of the vast majority of all crude oil and product tanks at the LA refineries and at some of the main commercial terminals, was to have been completed by 2006. The cost effectiveness of the program was questionable for the larger tanks, in particular for those containing crude oil, and the 4-year implementation schedule was deemed unfeasible and considered a risk to supply security. Feedback from the affected parties, industry organizations and the CEC (assisted by Stillwater Associates), caused the SCAQMD to reconsider the scope and implementation schedule.

The regulation, as adopted by the District's Board in a public hearing on December 21, 2001, requires that 75% of the tanks for gasoline and gasoline components are to be domed by December 31<sup>st</sup>, 2006 and the remainder by December 31<sup>st</sup>, 2008. The rule no longer includes a requirement for doming of crude oil tanks because it is not cost effective. Even with this extended schedule, there is still cause to be concerned that supply reliability in the LA basin may be impacted by the number of crucial storage tanks that will be out of service at any given

moment for project work. Under the applicable standard, API 653, aboveground atmospheric storage tanks are normally taken out of service for internal inspection and maintenance on a 20-year schedule, and the 7-year schedule with additional project work extending the downtime, means that on average during the next seven years, the amount of storage that is not available to accommodate demand swings or refinery problems is 3 to 5 times more than normal.

There is no doubt that the creation of a Strategic Reserve, or any other measure that will enable more storage to become available to the LA refiners within the extended timeframe of the new Rule, will help to alleviate the pressure on an already very tight market for bulk storage of petroleum products in the LA Basin and lessen the impact of Rule 1178 on the availability of storage.

### **5.3 Ports of Los Angeles and Long Beach**

Although joined by common waterways and infrastructure, the ports of Los Angeles and Long Beach are separate entities, each governed by a Board whose members are appointed by the elected officials of the two cities, with authority derived under a mandate from the State Lands Commission. The management mandate for both Port Authorities resides within a Master Plan for land use and development that is approved by the State Lands Commission (CSLC). Even within the Master Plan, certain decisions concerning land use and development will be subject to review by the City Council of each port and the CSLC.

Current policies in both ports do not favor bulk liquid operations for petroleum products, and the closure of existing facilities and lack of development opportunities for new capacity could severely impact the capability of the State to meet future requirements for fuels through imports. Almost all terminals in both ports are built on leased land, and as the leases come up for renewal, the ports will reassess the land usage, with the result that over time, more terminals will have to make way for large scale container operations or other land uses with higher revenue than can be offered by bulk liquids.

#### *5.3.1 Port of Los Angeles*

The current long term Master Plan for the Port of Los Angeles (PoLA) provides for the creation of a common bulk liquid terminal for crude oil and petroleum products on the newly created landfill area of Pier 400. The plan assumed that some of the existing petroleum terminals that were located in areas for which the PoLA had other plans would be relocated to this new bulk liquid terminal area on Pier 400 when their current leases expired. This plan, which dates back over 10 years, never gained acceptance

within the industry, mainly because the proposed site at Pier 400 is remote, requiring significant investments in pipelines in order to provide access into the existing refining infrastructure.

Given the lack of interest from the side of the industry, the PoLA has meanwhile granted most of the land of Pier 400 in leasehold to container terminal operators, with only a limited footprint remaining for bulk liquid facilities. The remaining area of 25 acres would allow building at the most three tanks of 0.5 million barrels each, which in combination with an 80-foot draft berth and a large capacity crude oil pipeline connection to the inland refineries will enable offloading of a fully loaded VLCC. The PoLA and several potential users are still evaluating the options for development of a crude oil terminal at Pier 400. In any event, it is very unlikely that any future development scenario for the site will include facilities for handling of clean products, and the net result will be that several clean products and black oil facilities will have been shut down in the PoLA without the anticipated replacement at Pier 400 being realized.

There are two other developments in the PoLA that could negatively impact the port's capability to handle imports of fuels. The first is formed by heightened community concerns about the safety of bulk petroleum storage as potential targets for terrorist attacks, which has led to a request by Council members to study the closure or relocation of three terminals in San Pedro and Wilmington. The second issue is that of Environmental Justice, a term used by NGOs protesting the disparity between the exposure to pollutants in the communities surrounding the Ports, with the poorer, largely minority populated communities bearing the brunt of the exposure.

Although understandable from a local perspective, these initiatives, if carried through, could lead to a further reduction in fuel receipt facilities in the PoLA and will make future expansion very difficult.

### *5.3.2 Port of Long Beach*

The Port of Long Beach (PoLB) faces problems that are to a certain extent different from those in Los Angeles. Both ports face an increasing demand for container handling – in fact, the projections for the PoLB call for a doubling of containers from the current 5 million TEU (Twenty-foot Equivalent Units) to 10 million by 2010 and then to double again to 20 million by 2020. Much of this growth will be realized by creating mega-terminals, container facilities with at least 400 acres of storage yards and capable of handling the new 10,000 TEU container vessels.

However, Long Beach does not face the same pressure from individuals or action groups concerned about safety or environmental justice. Yet the need to create space for container terminals is so acute that it is still uncertain whether the PoLB will be able to accommodate two existing bulk liquid storage facilities in the plans it has for expansion of the Pier A container terminal.

As is the case for the PoLA with its Pier 400 project, the Port of Long Beach has plans for a new deepwater receipt facility for crude oil at Berth 123, adjacent to the current crude oil berth shared by three refiners. The footprint for the new facility is expected to be very limited in size and in fact, would not include any storage at all. As for the LA Pier 400 plans, there are no plans for additional receipt facilities for petroleum products.

### 5.3.3 *Summary of Port Issues*

In Section 1.1.4 of this study, it was shown how California has become increasingly dependent on imports for its requirements of crude oil and petroleum products, and how the sources of these imports are shifting from domestic sources to remote foreign locations requiring larger scale receipt facilities. In section 1.3 it was shown how predominantly, the shortfall occurs in the southern California market, which relies on the ports of LA and Long Beach for its imports.

The current trends and policies in the ports of Los Angeles and Long Beach are not favorable to bulk liquid storage facilities, and although plans exist in both ports to accommodate future requirements for crude oil imports, there are no established plans for increases in clean petroleum products such as gasoline and gasoline components.

## 5.4 **Military fuels**

Jet fuel was not part of original study, especially military jet fuel, but the terrorist attacks have changed this outlook. Defense Energy Supply personnel in California would like to meet with staff and contractors. Proposed work would examine quantities and locations of military jet that should be stored and will examine delivery infrastructure constraints.

## 5.5 **MOTERP**

After the 1994 Northridge earthquake, and other earthquakes in which marine terminal facilities were damaged, the California State Land's Commission initiated a project to create a set of uniform engineering standards that would ensure that marine oil terminals would be equally resistant to earthquakes as the refineries to which they are linked.

Currently the CSLC has a final draft in preparation of new regulations that will require the owners of a high-risk facility (risk of a spill of more than 1,200 bbl of petroleum products in a standardized accident scenario), to inspect their docks and shore facilities within 30 months after the regulations take effect. These inspections will follow a detailed protocol and an action plan must be developed to mitigate any findings. Lower risk facilities have 48 months in which to carry out the inspection program.

The CSLC will evaluate each plan on an individual basis, and in general, does not impose a hard time limit for completion to allow the concerned terminal operator to design a workable schedule, which minimizes impact on operations. In general, the CSLC believes that most facilities can be remediated within 6 to 8 years.

Given the scheduling flexibility, it is not expected that MOTERP implementation will lead to an immediate reduction in available import facilities, as is the case for SCAQMD Rule 1178. Nevertheless, there are likely to be facilities for which the cost of the upgrades cannot be justified by the operator, and which will therefore close down.

## 6 OPTIONS FOR A STRATEGIC FUEL RESERVE

A fundamental choice for creating a Strategic Fuels Reserve is whether to use existing inventory capacity or to build new tankage. As seen in the previous Section 4, by conventional logistic standards existing tankage is already inadequate for the volumes currently handled. Moreover, during the stakeholder meetings, the shortage of existing storage capacity was widely reported as one of the major problems the industry currently faces (see Section 8.1). This study will therefore focus on adding new storage capacity or converting existing tankage currently not in petroleum products service as the only viable way to create an eventual reserve in California.

This study does not attempt to develop any of the considered options to a level of detail where cost estimates can be prepared with the accuracy normally required for an investment decision. At this stage of early feasibility analysis, order of magnitude estimates are used, where possible based on factorial comparison with known costs for similar projects, or based on published information and industry practice.

### 6.1 New Tankage

For new tankage, the primary considerations is the selection of a location, in particular whether the storage needs to be built as a grassroots project requiring its own infrastructure development, or whether it can be built as an extension to existing facilities and share in already available infrastructure such as roads, docks, pipeline connections, and utilities. For the first option, reference will be made to existing studies, while for the latter two locations are examined in more detail.

#### 6.1.1 Findings of 1993 Study

In 1993, an extensive study was carried out by Invictus Corporation of Wilton, CA, to determine the feasibility and cost for a single reserve of petroleum products, capable of holding an inventory of 5 million barrels<sup>32</sup>. The costs of the project, including acquisition of a 215 acre site and connections to the main product distribution pipelines, but excluding the cost of an initial fill of the reserve, were estimated at \$131 to \$143 million (1995 \$). Operating cost for the facility were evaluated at \$6.6 to \$7.9 million per year, with the high end of the range representing a location in Stockton that included operating a dock. The other locations that were evaluated for the reserve besides Stockton were Fresno and Roseville. These three locations were retained after

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<sup>32</sup> *Feasibility Study of a Regional Petroleum Product Reserve in California*, December 1993, Invictus Corporation, Wilton, CA, Resource Decisions, San Francisco, CA, and Capital Research, Chevy Chase, MD.

an initial survey that included a total of 15 sites, mainly inland and chosen for reasons of earthquake security rather than connectivity with existing petroleum infrastructure.

If escalated for inflation from 1995 to current<sup>33</sup>, the construction cost for the Stockton option would amount to \$154 million, or \$31 per barrel of shell capacity, and operating cost of \$0.16 per shell barrel per month. These numbers are similar to numbers quoted by major oil companies as fully loaded costs. In general, commercial terminal operators reported substantially lower numbers for new grassroots construction, claiming that they are able to build and operate terminals cheaper than the major oil companies or the State because of their specialized knowledge and lower overheads. If the project were to be realized as an expansion of an existing facility, with infrastructure already in place, costs could fall to half the numbers used by Invictus, based on information received from commercial terminal operators currently involved in expansion projects.

In addition to the construction and operating costs, Invictus evaluated the cost of filling the reserve at more than \$150 million at then prevailing fuel prices. The conclusion of the Invictus study, using an economic model to predict the price moderation effect of the reserve in case of a major supply disruption, was that the costs of building, filling and operating the single 5 million barrel reserve was not warranted by the increase in security of supply.

The 1993 study did not address the logistics of moving product in and out of the reserve, other than the pumping costs for the initial fill, and as has been shown in section 2.1.3 above, the concept of the single, central reserve would have been flawed because of the inability of the existing transportation system to deliver products to the different markets in a timely manner. Also, the concept of tying the reserve into the distribution grid with a single 8" line would have proven impractical, since it would have taken almost two months to draw down or replenish the reserve. Yet the cost estimate is representative for grassroots investment, and will be used in the build-or-buy analysis below.

### *6.1.2 New Storage Built and Operated by the State*

For new storage to be built and operated by the State, the following overall scope will be assumed to meet requirements for full integration into local refining centers and import capability:

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<sup>33</sup> Bureau of Labor Statistics Data, *Producer Price Index All Industries*. 1995: 124.2; 2001(p): 133.5

- Bay Area: 6 x 150,000 bbl drain-dry open floating roof tanks, 15 acre site owned fee simple, dock 800 feet long, 35 feet draft, VDU, 5 mile 16” pipeline connection to main grid.
- LA Basin: 9 x 150,000 bbl drain-dry floating roof tanks with dome, 20 acre leased site, use of 3<sup>rd</sup> party dock, 2 mile 16” connection to main grid.

The differences in scope between the Bay Area storage and the LA Basin facility reflect a reasonable estimate of prevailing local conditions, i.e., leased versus owned land and SCAQMD requirements.

If the reserve is to be part of a larger project, i.e., if double the volume is deemed necessary, or if additional storage were to be built simultaneously for lease to third parties as part of a larger, commingled terminal in which both the State and private entities maintain inventories, then there will be certain economies of scale from which the State would benefit on a proportional basis. For the time being, as a conservative first approach, the costs for building the reserve will be calculated on an individual project basis.

Summary of construction and operating costs (for details see Attachment \_\_\_):

Table 6.1 – Cost Summary of State Owned and Operated Reserve

	Bay Area	LA Basin	Total
Investment, \$ MM	39	36	75
Fixed Costs, \$ MM/year	8	9	17
Throughput Cost, \$/bbl			
Pipeline In/Pipeline Out	0.34	0.34	
Pipeline In/Barge Out	0.25	0.44	
Vessel In/Pipeline Out	0.23	0.41	

The total investment costs of \$75 MM for 2.2 MM bbl are consistent with the figure of \$154 MM of escalated costs for the 5 MM bbl storage of the earlier Invictus study, in that it would imply an exponential scaling factor of 0.88, which is conservative when compared to the value of 0.7 to 0.8 generally used in the industry for this type of installation (a higher number means a more linear relationship between scale and

costs, a lower number means that on a per unit basis, smaller installations are more expensive).

The throughput costs are the cost related to moving material in and out of the reserve, such as the fees for using the 3<sup>rd</sup> party owned pipeline gathering systems, port fees, dock fees paid to 3<sup>rd</sup> parties for options where the dock is not owned, and the cost of physical losses associated with the movement of the material, such as evaporative and trans-mix losses, which are estimated to average 0.1%.

### 6.1.3 *New Storage Built and Operated by a Commercial Service Provider*

Market information obtained during the survey meetings has confirmed that commercial terminal operators in the Bay Area and in the LA Basin are willing to build new storage capacity under a long-term, i.e., 10 year contract at currently prevailing market rates of \$0.45 to \$0.55 per barrel of shell capacity per month.

Table 6.2 – Cost Summary for Leased Reserve

	Bay Area	LA Basin	Total
Investment, \$ MM	0	0	0
Fixed Costs, \$ MM/year	5.4	7.2	13.6
Throughput Cost, \$/bbl			
Pipeline In/Pipeline Out	0.33	0.33	
Pipeline In/Barge Out	0.25	0.44	
Vessel In/Pipeline Out	0.23	0.41	

The fixed costs are based on the minimum fixed tank rental of \$0.50/bbl/month, which under the terms customary in the industry includes the right to store and withdraw the tank volume once per month (one “turn”). Any excess throughput in a given month incurs an additional throughput fee, usually in the order of \$0.20/bbl. However, no excess throughput charges are included in the Through Put Costs as listed, since it is unlikely that a reserve could be utilized and replenished more than once during one month. The throughput cost for the leased tankage in terms of pipeline and port fees, and inherent product losses, are virtually equal to those for owned tankage. The slight reduction for the pipeline in/out option is due to the energy cost for pumping, which are included in the base cost for leased storage.

It will be clear from a comparison of Tables 6.1 and 6.2 that it will be difficult to justify building state-owned and operated tankage, given the very competitive prevailing market rates of commercial service providers. The disparity between commercial rates and fully loaded costs incurred by large corporations is further explained below and is consistent with market information received during the survey meetings with industry stakeholders as conducted for this Study (Section 10.1).

## **6.2 Incentives for Increased Inventories by Current Inventory Holders**

An idea that was floated during the stakeholder survey meetings was that of an industry-held component to an eventual reserve, i.e., that by providing incentives to compensate for the cost of working capital associated with larger stocks, the current holders of inventories could be enticed to increase the amount of product held at any point in time, and would only dip into a certain portion of their inventories under pre-agreed conditions or when specifically authorized to do so. On reviewing inventory data and from feedback received during the stakeholder meetings, it became immediately clear however that there is little or no room to increase inventories within the California refining and distribution system.

The same arguments that apply to inventories at refineries also apply to those held at commercial terminals: space is tight and even when provided with incentives to compensate for working capital cost plus tank rental expense, owners of fuels would not be able to find more space.

This leaves the option to provide incentives to the industry that will result in more storage capacity being built. These incentives can take the form of providing financial aid, such as investment guarantees or subsidies, but can also include measures to remove the barriers that currently prevent normal free market mechanisms to cause supply to match demand,

### *6.2.1 Financial Incentives to Increase Storage Capacities*

Currently the contract rental rates for petroleum product tankage are around \$0.45 to \$0.50 per bbl per month in the Bay Area, and \$0.50 to \$0.55 per bbl per month in the LA Basin. Spot contracts can be between 5 to 10 cents higher. At these rates, commercial terminal operators have reinvestment economics, but large refiners would need higher numbers to justify building new tankage for themselves under the criteria that most of these companies apply for internal rates of return.

There are several reasons why a large refiner's costs are higher, and they are relevant when considering what incentives may be needed to promote infrastructure investments:

- A large refiner's project costs are generally substantially higher than those of smaller specialized firms because of allocated corporate overheads, more elaborate company standards, and higher cost of the owner's project management team.
- Required internal rates of return are higher in oil companies where projects generally carry significant risk and therefore need higher rewards, versus the service industry whose projects are usually backed by long term contracts with low risk and are therefore acceptable at utility level returns.
- Oil companies do not benefit from certain tax advantages available to most commercial terminal operators, who are often structured as Master Limited Partnerships (MLP).
- Capital resource allocation decisions in oil companies will favor investments in core businesses such as exploration, production and refining, rather than in infrastructure projects.

These factors have led to a proportional under-investment by refiners in storage, causing their inventory capacity to lag behind their increases in production capacity. In general, storage capacity will only be added at refineries when justified by operability issues rather than economic reasons.

Trading companies or large purchasers of fuels, who also maintain inventories, face similar obstacles to investment in wholly owned terminals and pipelines. In addition, these companies are generally not well equipped to run capital projects of this nature, have even higher internal hurdle rates for investment, and have a forward demand that is not always predictable.

The logical conclusion would be for refiners, traders, and large buyers to outsource their storage requirements to specialized third party service providers. For short-term requirements that can be met with existing capacity, this is indeed how the industry functions. However, this solution of choice becomes more complicated when the service provider has to invest in new facilities to meet the demand. For new investment, given their inherently lower utility level rates of return, the service companies need long-term commitments from the principals before they can invest, usually in the order of 5 to 15 years.

Unfortunately, it is almost as difficult for refiners, traders and buyers to commit to a long-term contract, as it is to obtain approvals to spend the capital internally. Long-term

capital commitments are also referred to as pseudo-capital commitments, which have to be footnoted in financial statements and may impact a company's borrowing capability in a similar way as debt incurred to finance investments. Thus the problem becomes a vicious cycle, in which the holders of inventory are reluctant to invest in owned infrastructure, nor eager to commit to long-term contracts, and the service providers unable to invest without such commitments.

A measure available to the State to promote new infrastructure investment in the petroleum sector would be to offer guarantees for certain projects under well-defined conditions. For instance, rather than renting storage for 0.9 MM bbl of state-owned reserve in the Bay and 1.3 MM bbl in LA, the State could:

- Offer a tender for commercial storage operators to build the required volumes of tankage.
- The commercial storage operators rent out tankage at normal rates to refiners, traders and marketers under short-term agreements.
- If for some reason, tankage is not rented out for longer than a certain minimum delay period, the State would reimburse the operator for the fixed cost and capital recovery part of the monthly rental fee, but not the profits.
- Contracts for the guarantees would be awarded to those commercial terminal operators offering the lowest required monthly guarantee, after the longest delay, over the shortest overall number of years of validity of the guarantee.

The advantage of this option is that it is unlikely that it will ever require the State to spend any real money, but that it will allow the commercial operators to build tankage without long-term commitment from customers. This solution can be combined with other initiatives, whereby the State would rent part of newly built reserves itself and fill it with State owned reserves, while allowing the commercial terminal operator to rent out the remainder under the guarantee program in commingled tankage. The resulting combination is one of the solutions of which the economic effectiveness will be evaluated in Section 8.

### *6.2.2 Removal of Barriers to Infrastructure Projects*

The main reason why normal laws of supply and demand do not function in the market for bulk liquid storage for petroleum products is the formidable efforts that must be undertaken to obtain the necessary permits. Even permits for a relatively modest

expansion took over three years to obtain. This project was located in a heavily industrialized area, for tankage that was in fact a replacement of military fuel storage removed nearby, and was undertaken by one of the leading companies in the field <sup>34</sup>.

Several factors complicate the permitting process:

- In the refinery centers in the Bay and the LA Basin, the areas where storage is most in demand, the permitting process for new tanks involves approval processes with multiple regulatory agencies. These processes are largely sequential and involve public review at several stages.
- Even when approved after all due regulatory review, projects can be held up indefinitely in court by Non Government Organizations (NGOs) representing interests of communities, even if projects are located in remote areas zoned for industry with no residential habitation in the direct vicinity.
- The NGOs that represent the local interest operate nationwide, are relatively well funded, and benefit from better central coordination and more favorable press relations than the industry.
- Permit applications for individual projects may require a lengthy procedure to update the Master Plan for land use in the ports as laid down in the State Land grants under which the Ports operate, while granting an exemption leaves the Port Authorities vulnerable to suits filed by opponents.
- The Port Authorities and other local regulatory agencies that have control over land use are not always aware of the greater interests at stake, and may have to give priority to interests of local electorate.
- The momentum in the Ports is building against bulk liquid terminals, with several terminals in the Bay and in the LA Basing closed down in recent years, and several more currently under scrutiny.

In summary, the current regulatory environment is such that it is easy and cheap to prevent infrastructure from being built, while filing project applications is uncertain and costly. Measures that the State could consider as options to ensure an adequate infrastructure for fuels, including a Strategic Fuels Reserve, are:

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<sup>34</sup> Information received during Stakeholder Meetings.

- Centralizing the permitting process for bulk liquid storage and pipeline projects for fuels (“one stop shopping”)
- Preparing blanket Environmental Impact Reports (EIR) for major changes, such as CARB Phase III implementation, whereby the overall macro-environmental impact factors are defined centrally, so that for individual projects, only local factors need to be considered.
- Introduction of a fast track procedure for fuels infrastructure projects that improve overall fuel supply reliability in the State.

These measures will enable normal market supply to meet the inherent demand without direct intervention or significant expenditure of taxpayer money. Similar measures were enacted for the power generation and transmission infrastructure, but only after 13 years had passed in which no new capacity was added, and a real crisis had sprung up. The challenge is to implement this type of program as a preventive measure rather than in a crisis environment, given the political hurdles at local level.

### 6.3 Recommissioning of Idle Tankage

Given the tightness of the bulk liquid storage market in California, there is no tankage that is currently left idle that does not have some significant problems associated with it that prevent its re-commissioning.

#### 6.3.1 *Idle Tankage linked to Refinery Infrastructure*

A survey of the LA Basin and the Eastern Bay Area, the primary areas for location of an eventual strategic fuels reserve, revealed some terminals with decommissioned or otherwise idle storage with sufficient capacity to be considered for service as a Strategic Fuels Reserve. This tankage is mainly associated with power stations and closed-down refineries.

Table 6.3 – Summary of Idle or Decommissioned Tankage

	Bay Area	LA Basin	Total
Tankage at Closed Refineries	0.0	1.7	1.7
Fuel Oil Storage at Power Plants	4.0	3.5	7.5
<b>Total</b>	<b>4.0</b>	<b>5.2</b>	<b>9.2</b>

Several factors make it unlikely that the idle storage identified in Table 6.4 can be brought on-line again economically:

- For 1.0 MM bbl of refinery storage in the LA Basin, rates quoted by the owner for rental of the recommissioned tanks are 60 to 80% higher than the cost of new built tankage. This high cost is likely to be due to the factors quoted in Section 6.2.1 listing some of the reasons why large refiners incur substantially higher net project costs.
- The remaining 0.7 MM bbl of idle refinery tankage is associated with a refinery that may still be reactivated and its storage is not separately available.
- In total, 3.5 million barrels of idle power station fuel oil storage was identified in the LA Basin, and up to 4 million barrels in the Bay area. This idle tankage consists for the most part of older tanks that are neither suitable nor permitted for storage of high vapor pressure products. To make these tanks suitable will require significant investments, and the permitting process will be similar to that for new tankage. Moreover, the individual tanks are usually very large, i.e., in the range of 300,000 to 500,000 bbl per tank, which renders them less useful for product storage (see Section 2.2), while pipeline connections with the clean products distribution system would have to be created using whatever black oil lines are available.

Despite the obstacles, it seems likely that using existing tankage will result in some savings in time and project costs versus building new tanks for the reserve. Evaluating each of these options in sufficient detail to quantify cost savings versus new construction requires a level of engineering work not foreseen in the scope of this study. At this stage of early feasibility evaluation, it seems reasonable to assume that if a tender for the creation and operation of a reserve were issued to service industries operating in the LA Basin and in the Bay Area, and if those companies would be able to offer services at more competitive cost by using the idled power station tankage, then normal market forces would drive inclusion of these alternatives in the proposals to the State. For now, no significant cost reductions will be assumed.

### *6.3.2 Tankage Not Tied to the Distribution System*

Only a few instances have been identified of idle tankage outside the refining centers, not connected to the main distribution system.

- In Ventura, 800,000 bbl of tank capacity associated with the former USA refinery. This tankage has been out of service for 15 years and would require major investment to be brought up to code. Moreover, dock facilities have been removed and substantial investment would be involved in converting a idled crude pipeline to products.
- In various coastal power stations, a total of 3 million barrels of former fuel oil tankage has not yet been removed. Most of these tanks are in poor shape, have no longer access to single point moorings or dock facilities, and are in locations where pipeline connections to the refining centers would require new pipelines through environmentally sensitive areas.

In total, the volume of such tanks that could in theory still be rehabilitated and made fit for service in light products may exceed the 2 million bbl required for the reserve. For all of the sites however, it makes no economic sense to attempt upgrade and connect the storage by pipeline to the refining centers, because even grassroots investment within the refining centers is bound to be more cost effective.

#### **6.4 Conversion of Tanks Currently in Black Oil or Crude Oil Storage**

In both the northern and southern refining centers, some tanks are currently used in black oil service (heavy fuel oil, VGO, bunkers, crude oil) that are capable of and permitted for storage of clean petroleum products. While surveys did not produce a complete inventory of all tanks with dual capability in California, with 1.5 MM bbl of identified tankage with commercial terminal operators in the LA Basin and at least 0.5 MM bbl in the Bay, it is estimated that total volume of such tankage exceeds the proposed volume of a Strategic Fuels reserve in each area.

However, using these tanks for a Strategic Reserve in light petroleum products is unlikely to bring an overall improvement of supply reliability in the State. Storage for black oil and crude is also very tight in both refining centers, and although commercial terminal rates for these products tend to be slightly below those of clean products in the current markets, the actual costs of the facilities that can handle the heavy products is higher. More often than not, black oil tanks and pipelines have to be heated and insulated, and pumps and other equipment have to be designed for highly viscous products.

If 2.3 MM bbl of tankage that has dual capability were to be removed from black oil and crude service to create a Strategic Reserve, this would represent less than 10% of available storage volumes for these products in the State. However, at less than 15 days of storage, crude oil inventory capability in California is already dangerously low by standards applied in most other

parts of the world. Especially with the crude supply situation changing rapidly and the State becoming increasingly dependent for its crude oil supplies on foreign imports from remote locations requiring Very Large Crude Carriers (VLCC), it would not be prudent to recommend creating a Strategic Fuels Reserve for light products in current crude oil tankage with light product capability.

Black oil storage capacity, in contrast, seems more generous, with more than 20 MM bbl of tankage available in commercial terminals alone. However, black oil storage requirements are not determined to the same extent as gasoline or crude oil in terms of days of throughput, but rather by operational requirements for intermediate product storage allowing refinery units to function somewhat independently from each other, in particular to enable partial shutdowns and turnarounds of upstream units such as cokers and distillation units, and downstream upgrading sections. As it is, black oil storage available to refiners has declined by over 8 MM bbl over the past years, with aboveground tankage being scrapped or converted to crude oil, and the last of the large inground reservoirs has been decommissioned. It is therefore not recommended to attempt creating a Strategic Fuels Reserve in either black oil or crude oil storage capable of handling lighter products.

## **6.5 Floating Storage using Converted Tankers**

Worldwide, many instances can be found where laid-up or obsolete tankers have been used to provide floating storage, usually as a floating dock and surrogate marine terminal, capable of receiving cargoes through a board-board transfer from a similarly sized or smaller vessel.

To evaluate this option as an alternative for a Strategic Fuel Reserve in California, a number of factors need to be considered, such as size and availability of vessels, the logistics of moving product in and out of the floating storage, and of course the approximate cost of maintaining tankers as storage.

Table 6.4 below compares a number of alternatives. From this table, it will be clear that it is not practical to assume that a reserve can be created using product tankers, simply because of the number of vessels that would be required and the cost involved. Even though availability is not the issue (it is estimated that in the next two years, 11 single hull US flagged product tankers will be retired <sup>35</sup>), the cost of maintaining the vessels at anchor and operating them as a floating terminal are likely to be prohibitive at an estimated \$24,000 per tanker per day. Moreover, at least in LA, the space is simply not available to anchor 5 of these vessels.

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<sup>35</sup> MARAD, *OPA Schedule for retirement of Single Hull Product Tankers*, Jan 2001

Table 6.4 – Alternatives for Floating Storage

	VLCC	Product Carrier	Reserve Fleet
Provenance	Foreign, newly retired vessels	OPA single hull retirement	NDRF
Size (DWT)	250 – 300,000	35 – 40,000	18 – 35,000
Draft (feet)	50 - 60	35 - 40	30 - 35
Capacity (bbl)	1.5 – 2 MM	250 – 300,000	175 – 300,000
Vessels required, Bay / LA	1 / 1	3 / 5	3 / 5
Costs (\$/bbl/month)	\$0.75 - \$1.00	\$2 - \$2.50	?
Cost product in/out (\$/bbl)	>\$0.75	>\$1.00	?

While also expensive, the use of one retired VLCC in the Bay and one in the outer harbor of Los Angeles, both permanently moored and equipped with fenders and loading arms for board-board transfers, is at least doable from a practical point of view. The difficulty here will be to obtain a waiver for the Jones Act requirement, since no US flagged VLCCs were ever built, and to obtain permitting for a single hull vessel to be used as floating storage. All these factors, as well as the high cost, make this an option of last resort, since it has the advantage of being able to be implemented at short notice, i.e., in less than 4 to 6 months.

## 6.6 Incentives to Increase Fuel Production in California

The need for an SFR is borne out of a chronic supply shortage of gasoline in California, where refiners run close to or at maximum capacity with import options limited by commercial and physical barriers. In such a situation, each unplanned refinery outage immediately translates into a price spike. If somehow, production capacity could be increased so that a healthy margin of spare refining capacity existed, as was the case up to the mid-nineties (see Figure 1.1), other refiners would be able to take up the slack and compensate for the loss of production due to unplanned outages.

It is clearly not within the mandate of AB2076 to evaluate whether the State should enter into the refining business. However, there are measures the State could consider with regard to increasing refinery capacity that could achieve the same goal of suppressing price spikes at potentially comparable or lower cost than are likely to be incurred in the creation of an SFR. In particular, the State could contemplate measures to streamline and expedite the permitting

process for projects that increase fuel production in California similar to the legislation introduced in order to accelerate capacity additions for power production.

Currently, the political climate in California is not conducive to the expansion of fuel production in the State. The consensus opinion amongst industry participants is that no new refineries will ever be built, although CEC forecasts of gasoline demand require the supply equivalent of an additional two refineries to be built between now and 2020, despite expected advances in fuel economies of cars<sup>36</sup>.

Problems that refiners face when contemplating even small capacity additions are:

- Many refiners are up against hard constraints in their CAAA Title V Operating Permit. Even a small debottleneck of one unit may require applying for a new overall operating permit. In many cases, this renders the project uneconomical.
- Emission credits are expensive and offsets are hard to achieve, which again means that small projects are often not attractive.
- NGO's have proved to be adept at slowing or eliminating needed expansions. Part of the decision that CENCO Refining made to abandon plans to restart the Powerine refinery can be attributed to lawsuits brought by environmental groups. Unions have delayed the permitting of CARB Phase III projects in refineries in Northern California.

Government agencies have enforced their own agendas to the detriment of fuel production and logistics. The Port of Los Angeles has tabled the relocation of terminals in their port. The South Coast Air Quality Management District's Rule 1178 will put pressure on the distribution system, risking supply disruptions because of tankage that is taken out of service for doming. Permitting is a time consuming process. It took Kinder Morgan two years to get permits for the construction and operation of three new jet fuel tanks at their tank farm in Watson.

Government can create incentives to increasing fuel production by reducing the barriers that government has created. These include a coordinated permitting process, a new look at permitting requirements, and one-stop shopping for all energy related projects, not just electrical power.

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<sup>36</sup> *Energy Outlook 2020*, California Energy Commission Staff Report, Docket No. 00-CEO-Vol II, August 2000

## 7 MARKET CONSIDERATIONS

The California markets for gasoline, diesel and jet fuel are each different in key aspects such as structure, liquidity, and forward trading opportunities. Of the three major liquid fuels, the gasoline market is not only the largest market by far, but also the most complex because of such factors as the uniqueness of the fuel specifications, the overall tightness of supplies and the relative inelasticity of demand. These and other factors underlie the severe volatility of the gasoline market and will be evaluated below, with the other markets, in particular the market for jet fuel, used only as a frame of reference.

### 7.1 General Description of the California Gasoline Markets

The California gasoline market has a layered structure, formed by four separate but interrelated markets:

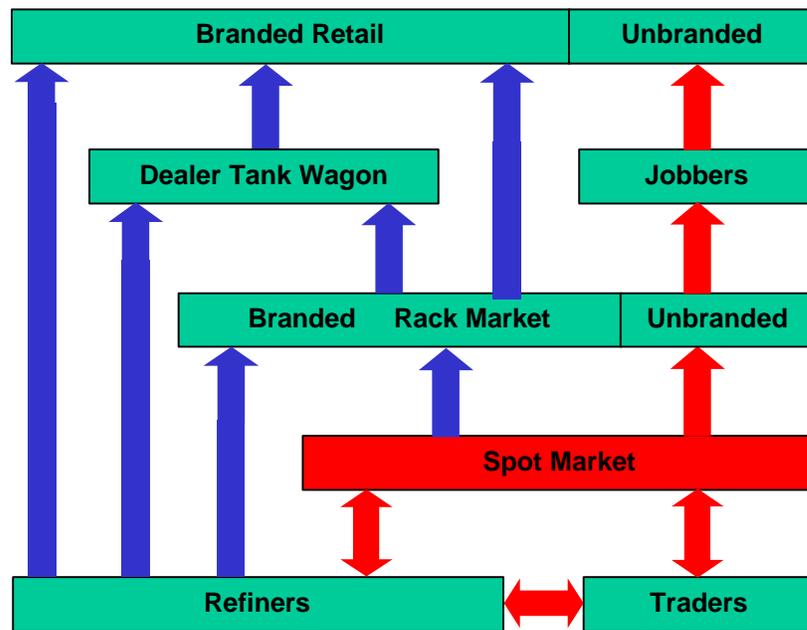
- **Spot.** The spot market consists primarily of the trade at the refinery level. Traded gasoline volumes are typically 25 MB (approximately 1 million gallons, also referred to as a “piece”) and are delivered into a pipeline at a place and time specified by the buyer. Most deals are “prompt”, meaning the first open cycle on the pipeline, usually within one or two weeks. There are some twenty to thirty participants in the West Coast spot market, including refiners who buy and sell products between themselves to balance out volume requirements, trading houses, brokers, and the large independent marketers. The spot market moves with the perceived change in refinery supply and demand.
- **Rack.** The rack market consists of wholesale buyers such as independent retailers and bulk customers who operate their own truck fleet (“jobbers”) and who take delivery of their product at a truck loading rack situated at a terminal, or sometimes directly at the refinery. Rack market participants may buy branded products destined for branded stations, or unbranded products destined for independent service stations or commercial/industrial accounts. In general, branded rack prices tend to move in relation to street prices. Unbranded rack prices tend to move with the spot market.
- **Dealer Tank Wagon.** The price of gasoline delivered to a branded retail site is termed Dealer Tank Wagon (“DTW”). In a stable market, DTW is set by review of competitive prices. In an unstable market, DTW tends to move with the change in spot prices, although the magnitude and duration of the changes can be different than those of the spot market.

- **Retail Market.** The retail market is where pump prices are posted. Street prices are normally set relative to prices of other local gasoline stations. Recently, a new force in retail is emerging in the form of High Volume Retailers (“HVR”), which are operated by large chain stores aim at large volumes at low margins. HVRs tend to price their gasoline on cost, rather than local competition.

**7.2 Pricing Mechanisms**

The spot market is essentially an over the counter market, with deals negotiated on an individual basis between participants. Reporting of deals and posting of pricing by reporting services such as OPIS or Platt’s occurs when both buyer and seller confirm the deal. In the California spot market, which includes deals made for supplies into Nevada and Arizona, there are between 20 and 30 active participants, and a “liquid day” is a day that sees four or five deals being concluded. More typical are days with only one or two deals. Not all reported deals are physical deals: pieces can be bought and resold several times, and become physical only when delivery is due by the final seller in the chain at the scheduled slot in the pipeline cycle.

Figure 7.1 – CA Gasoline Market Structure



Daily spot prices are driven by prompt market imbalances in supply and demand that are brought to a head by the weekly pipeline schedule requiring prompt physical delivery. Every spot purchase by definition is a one-time event. The buyer and the seller incur no obligation for future transactions, although forward deals may be transacted as adjunct to, or independently

from, the spot purchase. The cumulative effect of these transactions propels the price up when markets are tight, with several buyers chasing limited supply. In down markets, the price will descend in the absence of firm deals as sellers look for buyers at lower prices, while buyers back away. These imbalances can be as small as ten thousand barrels (10MB), with 25MB being the average 'piece'. If a refiner, marketer or trader is 'short' that amount of product and must 'cover', or purchase in the prompt spot market in order to meet physical delivery obligations, that transaction can push the spot price, as reported by OPIS up five to seven cents per gallon in a tight market. In other words, 25MB moves the deemed value of the entire gasoline inventory in the State because it represents, "the last deal done".

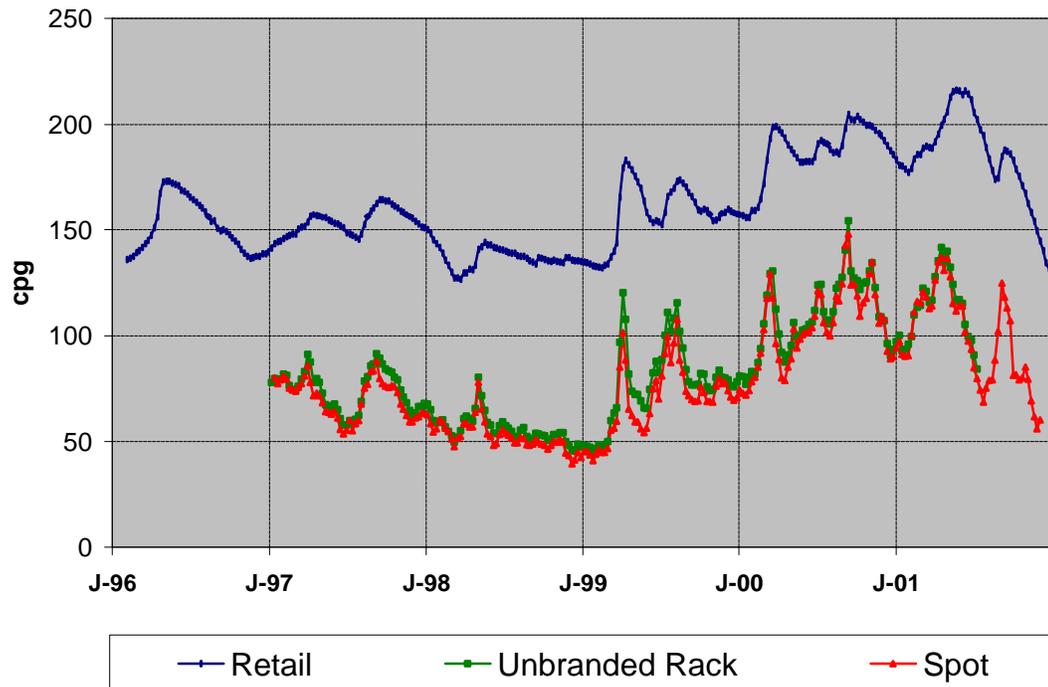
Rack pricing for gasoline is broken into two segments: Branded and Unbranded. Pricing of gasoline for these two classes of trade is complex, dynamic and interrelated. Branded gasoline wholesalers are subdivided into classifications of "jobbers" and DTW (Dealer Tank wagon) accounts. DTW prices represent the wholesale price paid by the dealer to a refiner for gasoline delivered in bulk to that dealer's retail outlets. Often the DTW price is higher than the unbranded rack, plus transportation. The branded dealer has, in effect, traded off the opportunity to take advantage of steep wholesale price declines during periods of oversupply, for a greater consideration of security of supply and an acceptable guaranteed margin over the long term. Imbedded in the DTW price is the deemed value of the supplying company's brand name.

Jobbers are those companies that service the market sector from the refiners' truck loading racks to end-user retail and consumer accounts. They establish credit lines with the refining companies sufficient to service their customer base and pick up their loads against pre-negotiated contracts. A jobber may service both branded and the unbranded accounts. They take title to the product as it passes the truck flange but may be restricted by contract to deliver certain loads only to branded customers in particular market zones. The refiners structure their contracts with the jobbers to prevent the delivery of 'unbranded rack' priced truckloads to 'branded dealers' when the unbranded and spot market prices are weaker. Conversely, they are not allowed to 'over-lift' branded gasoline during tight market and deliver those loads to the unbranded sector. Because of differences in zone pricing, even in the 'branded' sector the same jobber may pick up several loads from the same refiner on any given day and be charged a different price for each through a long-established value of TVA discounts (Temporary Voluntary Allowance).

Competition among the major brands in various metropolitan and even outlying areas rises and falls in intensity based on market-share strategies and promotions. Each market zone will be charged a price approximating what that particular market will bear, given its demographic position and a number of secondary factors such as traffic count, corner location and deemed

price-elasticity, nearest competitor, etc. The integrated refiners also operate their own truck fleets dedicated to branded gas station deliveries under the DTW system. Surveys of the major refining & marketing companies in the state have found that most do not post a meaningful 'unbranded rack' price. They remain balanced to short with respect to their refining capacity and their branded dealer downstream demand. Through recent mergers, the number of refiners supplying the unbranded rack market in significant quantities has been reduced from two to one.

Figure 7.2 – CA Gasoline Spot and Retail Prices



It is clear from Figure 7.2 that the unbranded rack price closely tracks the spot price, and that retail pricing, which includes a significant mark-up from federal, state and local taxes, follows the movements of spot and rack not only with a slight delay, but also with movements that are somewhat dampened by the fact that the refiners will protect their branded retail to some extent on the upswing, while holding on to margins a little longer on the downward slope.

Another important element of pricing is that of the transfer pricing policies within the integrated refining and marketing companies. The integrated oil companies produce crude oil, refine it, and distribute the products through their branded retail locations. None of major oil companies operating in California are completely integrated, since all of them are somewhat dependent on other companies (or countries) for crude oil supply upstream of the refinery and product supply

or offtake downstream of the refinery. In order to help measure their performance, the refiners have to have a benchmark for the crude oil and products markets. In general, they use the spot market for this gauge. They assume they are buying crude oil from their producing company at the spot, refining it, and selling the products to their retail organization at spot prices. The retail organization receives product at a spot price and sells it at retail. Their relative profitability can be described as DTW or Rack Price minus Spot Price minus expenses. This permits a company to quantify the relative profitability of each link in its supply chain.

### **7.3 Effect of Insularity**

For petroleum products, California is an insular market, separated from world markets not just by geographical distance, but also by product quality aspects, commercial barriers and infrastructure limitations, all of which cause price differentials above mere transportation cost. There are many examples of markets that are insular in nature, sometimes because they literally are islands, such as is the case for Hawaii or Japan, sometimes because of protective tariffs, and sometimes, as is the case for California, because of a complex set of factors that prevent a free flow of goods when price differentials would dictate they do.

The relationship between price differentials between markets and the total cost to move goods between them, including transportation, duties, storage, time value of money, etc., is referred to as geographical arbitrage, or “arb”. The arb is said to be open when the differential is large enough to leave a profit to the importer, and the arb is closed when differentials do not justify movements.

In closed economies, local prices can be substantially above world market plus transportation costs because of restrictions on imports or duty barriers. Usually, high local prices then are indicative of inefficient production or limited competition, or a combination of the two.

In open economies, such as is the case for California, local prices should be at world market prices plus transport cost. However, sometimes for prolonged periods, California prices are substantially higher. Since California refineries are amongst the most sophisticated in the world, and since temporary situations of oversupply during winter months immediately result in severe price drops – as was the case as recently as December 2001 through January 2002 – it can be concluded that the insularity of the California market has not resulted in inefficiencies or uncompetitive practices. The only remaining explanation for the prolonged price excursions above world market plus arb is therefore that import options are indeed restrained by physical reasons (terminal capacity) and commercial factors (price volatility),

It is important to note that because on average, California refineries are efficient and low-cost, and are engaged in open competition, imports are not necessarily going to lower the average price. Rather, the import dependency has caused an increase in the incremental cost of supply, which in turn raises the price of the entire market and increases refining margins. The effect of an eventual SFR maybe to lower the cost of imports and reduce price spikes, but it will not lower the price of gasoline to the incremental cost of production within the State itself.

#### **7.4 California Fuels Forward and Futures Markets**

A forward market is a market in which a buyer and seller agree to a physical transaction with a future delivery date, but for which prices and delivery terms are agreed at the time of the transaction. The advantage of a forward market is that it allows a buyer and seller to lock in margins over cost on a specific shipment. However, both buyer and seller take a risk that the market may shift and either party to the agreement stands to lose or gain substantially on the deal when compared to the market conditions that may prevail at the time of physical delivery. A forward transaction implies integrity on the part of both parties to honor the commitment despite market changes. The spot market in Los Angeles currently has only a very thinly traded forward market component, i.e. only one or two forward trades are typically conducted per week , and rarely for more than one month into the future.

A futures market is a market in which non-physical trades are conducted using standardized contracts under which factors such as product specifications and delivery terms are defined. Futures are transacted between licensed traders in open auctions on a trading floor rather than directly between principals, with the exchange acting as the clearinghouse for all transactions. Futures markets, such as the NYMEX (New York Mercantile Exchange) in New York and the IPE (International Petroleum Exchange) in London are subject to government regulation. Since buyers and sellers do not deal directly with each other, but rather through the institution, or clearing house, a system of margin calls and allowable "open interest" (total number of contracts, long or short, in a given month for a given company) is strictly enforced to ensure the integrity of the Exchange. At the NYMEX, futures are traded for crude oil, gasoline, and heating oil. The advantage of a futures market is that it allows parties to a forward contract not just to lock in prices and margins over costs, but also to lock in prices relative to prevailing market conditions at some future point in time. Using standardized futures, a seller can hedge a physical forward sale by offsetting it with a non-physical forward buy of another commodity that generally moves in the market at a fixed differential to the commodity he wants to sell at some future date. The process of reducing future market risk by entering into offsetting selling and buying agreements is called hedging.

A thinly traded forward paper market does exist in California but with insufficient volume to provide a bridge to a traditional futures contract. In the absence of a forward or futures market, a trader or importer bringing products into California takes a significant gamble, given the volatility of the market. The importance of the existence, or rather lack thereof, of future or forward markets for the California fuels situation lies in the insularity of the California markets in general. A potential importer of a cargo of gasoline typically has to take a decision to produce and load a cargo 6 to 8 weeks before it will reach the market. Even though the spread between production costs plus shipping costs and the California market price may be very attractive at the moment a decision has to be taken, the situation may be reversed by the time the cargo finally reaches the market. Many importers would prefer to lock in a known margin of 1 or 2 cpg at the time of shipment, rather than take a gamble that a 20 cpg price spike in the California market will last until their cargo arrives <sup>37</sup>. A cargo of gasoline arriving on Friday could be valued at twenty cents per gallon lower than one arriving on Monday of the same week, a potential loss of millions of dollars.

Because the lack of forward price protection inhibits out-of-State suppliers from delivering cargoes to California, price spikes are exacerbated and become long plateaus of relative price elevation. A futures market would enable hedging and liquidity, which in turn will attract cargo re-supply when needed.

The question now becomes, what can be done to promote liquidity and create forward and futures markets for California gasoline. A survey of a broad range of market participants, including Futures Markets planners and administrators, confirmed that the prerequisites for a commodity futures contract to take root in any market are:

- **Market Liquidity.** There must be a minimum number of buyers and sellers in the market, each with different business orientations, who together form sufficient critical mass to conduct a minimum number of transactions daily.
- **Fungibility.** There needs to be an established transaction flow in a product with a common specification or with established price differentials to other commonly traded commodities. Heating oil, for example, has been a very successful NYMEX commodity because its specifications can cross over to a number of markets: Jet fuel, transportation diesel, home heating oil, kerosene, etc. Diversion from this basic commodity spec can be evaluated in the physical market between buyers and sellers. The NYMEX contract can still be used as a basis for exchange after factoring in such value differentials. California

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<sup>37</sup> Information received from all traders and importers during the Survey meetings with industry Stakeholders.

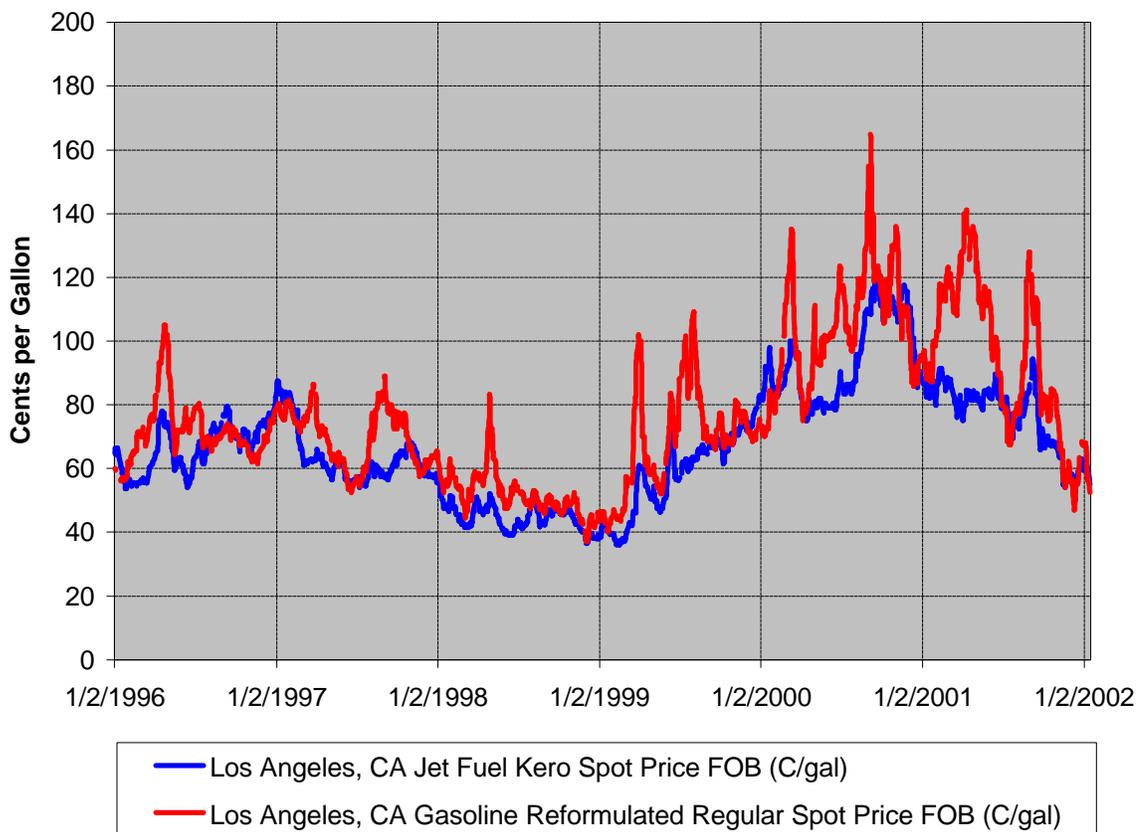
gasoline and CARB diesel, on the other hand, are unique formulations that contribute to the isolation of the State and to price volatility. This is one of the major obstacles for establishing a liquid futures market in California.

- **Physical Delivery Point.** A futures contract buyer, also known as 'a holder of a long position' retains the legal right to demand physical delivery of the commodity upon expiration of that contract. Without a basis in guaranteed physical delivery, a commodity futures market would be merely an arena for speculating on price movement in the absence of underlying value. Given this necessity for physical delivery, California has never been seen as a fertile field for a traditional futures market, such as NYMEX to take root. There is no common storage available to non-California refiners or international traders. It has been noted that the Kinder Morgan (KM) pipeline gathering system could serve as such a delivery point, if it were to be linked to common storage accessible to various classes of trade. Existing refineries and most product terminals are already connected to the KM gathering system. A State sponsored SFR commingled with private sector inventories could provide the common storage that could form the physical delivery point for a standardized futures commodities contract.
- **Multiple Supplies.** There should be a variety of supply points into the locus of the futures contract. NYH is easily accessible by vessel from such diverse points as Northwest Europe, South America, the US Gulf and Caribbean areas.
- **Diversity of participants.** Besides diversity of geographical supply points, the participants should also represent a diversity of interest in order to ensure market liquidity. For example, in New York Harbor (NYH), besides the refiners and global traders, there are over twenty-five local companies involved in shipping, blending, trading, marketing, etc. These spot-market oriented companies tend to depress price spikes by blending batches to meet local demand. Gasoline blending is not feasible in California outside the refining systems due to the lack of available storage, the Unocal Patent barrier and the severe penalties attached to off-test blends. The greatest part of a futures market's liquidity actually comes from non-integrated traders and energy companies. The integrated majors tend to regard their integrated supply chains (i.e., Crude ⇒ Refinery ⇒ Distribution System ⇒ End Customer), as a natural hedge against price aberrations that occur at any point in the value chain, such as local price spikes in gasoline or heating oil.
- **Day-to-Day Participation.** A commodity market is most effective when buyers and sellers enter the market every day. A stop and start system, as would be engendered in

a boutique fuels market such as California gasoline, does not lend itself to a viable futures market.

One finds most of these prerequisites fulfilled in connection with the Los Angeles jet fuel market, but not in gasoline where there is no common specification, no common storage and no established transaction flow from alternate sources. Consequently, the price volatility for jet fuel is far lower than for gasoline as illustrated in Figure 7.3. While jet fuel tracks the same underlying trend as gasoline, which is mainly related to crude oil pricing, the jet prices do not show the spikiness and volatility of gasoline.

Figure 7.3 – LA Spot Prices for Jet Fuel and Gasoline<sup>38</sup>



It should be noted that futures trading has sometimes failed in other markets. The NYMEX U.S. Gulf Coast Heating Oil and Gasoline contracts, for example, could not generate enough liquidity (transaction volume) because the Gulf Coast is essentially a supply center rather than a consuming center. In theory the contract had a chance to work, in that Gulf Coast refiners might want to hedge their production locally. Instead, they preferred to continue using the

<sup>38</sup> Source: EIA daily spot prices

destination market of NYH on a net back basis (NY price minus a differential). Singapore crude oil was another failed experiment. A Brent vs. Dubai (European vs. Asian) crude contract was established in the mid nineties to capture more efficiently the international flow of cargoes and prices. The contract was ultimately under-subscribed, largely because of an Asian business culture that prefers negotiated deals to anonymous, electronic transactions. Basically, these experiments lacked one or more of the prerequisites indicated. Nonetheless, a California futures market for gasoline, diesel and perhaps blend stocks could emerge in the private sector through the operation of an SFR if the following strategic elements are incorporated into it:

- SFR inventories are commingled with private sector inventories.
- The tankage is connected to the Kinder Morgan gathering systems in the Los Angeles basin and in the Bay Area.
- Use of the SFR inventory is triggered by time-trades, or buy-sell agreements rather than outright sales.
- Access to the SFR inventories is open to various, pre-qualified classes of trade.
- The SFR has direct waterborne access for incoming cargoes and can serve as the physical delivery point for a futures market.

## **8 DESIGN AND EFFECTIVENESS OF THE RESERVE**

Based on the above, the most effective design of a reserve will be that which will function not as a stagnant inventory set-aside program, but as highly liquid physical delivery point for imports, fully integrated into the refining infrastructure, marine terminals, and distribution pipeline systems, with its volume accessible to qualified participants as a “bank” from which supplies may be drawn against a fee, with repayment in kind within a specified time frame.

The very existence of such a bank will provide a center for discharging incoming products cargoes. By virtue of being located at the head of the distribution pipeline systems the SFR will provide a clearing center for price and transaction liquidity. By commingling any State-owned inventory with private sector supplies (similar to the Heating Oil Reserve in NYH), a double benefit can be gained. First, the commingled product will be constantly “turned over” in the normal flow and scheduling process. This will insure seasonal quality integrity and prevent quality degradation. Whether release of State-owned SFR inventories are to be triggered by pre-defined price formula, or unscheduled refinery events under one model, or by a regular withdrawal allowance system as an “oil bank” under an alternative model, the effect of such release will be to draw the island of California more rationally into regional price and logistic patterns (geographic arbitrage).

### **8.1 Tank Space**

Based on the findings of Section 6 above, tank space will have to be newly created, and the most cost effective way of doing so is by issuing a tender for bids by qualified commercial storage operators for a long-term, i.e., 10-year contract for storage space. To suppress the cost of the State’s share and to help create storage space for use by third parties not normally capable of entering into the long-term agreements tank operators need as financing prerequisites for new storage, the State could request double the amount of tankage to be built, but offering only minimal guarantees for the excess capacity, with would oblige the commercial operator to exercise best efforts to find lessors.

Assuming that the base 2.5 MM bbl can be leased for \$0.50 per bbl per month for a cost of \$15 million per year, and that the State’s guarantee for the additional 2.5 MM bbl will be \$0.35/bbl/month, and the guarantee on average will be evoked for 10% of the time, costing the State an additional \$1 million per year, then the total cost for the storage will be \$16 million per year.

With the tanks operated as a fuel bank, all additional operating costs identified in Section 6 above, such as volume losses and pipeline fees, will be absorbed by the parties drawing from the reserve and replacing it.

## 8.2 Initial Fill

Based on a recent-years historical range of gasoline prices from 50 to 130 cpg, the initial fill of 2.5 MM bbl can cost anywhere from \$50 to \$140 million. There are however several alternatives open for the State to minimize the upfront capital outlay for this purchase.

Firstly, a partial offset can be claimed against the Federal Petroleum Reserve, because volumes held in reserve as products in California need not be covered by a corresponding amount of crude oil in the Texas caverns. This mechanism was also used in part to fund the Eastern Heating Oil Reserve.

Secondly, the fuel will not be consumed, but will remain substantially in place as collateral, with guarantees in place from qualified participants for volume lent out at any point in time. It should therefore be possible to secure debt against the collateral, possibly subject to margin calls if the underlying risk of fuel price fluctuations cannot be entirely secured by forward rolling hedge mechanisms.

A reasonable estimate therefore seems to be that the costs of the initial fill can be reduced to the cost of the debt service on part of the purchase costs, possibly in the range of \$5 to \$10 million per year.

In order not to cause a market disruption, it will be important to purchase the initial fill quantity gradually, preferably during the winter season and from remote sources. Contrary to what has been suggested in AB2076, it is recommended to include local refiners in parties allowed to bid on tenders for the initial fill. During the winter season, some spare capacity usually exists in the California refining system, and the local refiners would be able to use imported blendstocks to complement local capacity to produce CARBOB for storage in the SFR.

## 8.3 Participants

Access to the reserve volumes is one of the key questions that was raised during the Stakeholder Meetings. The options on this issue range from an entirely open forum, whereby even non Industry participants capable of posting financial guarantees would be invited to an SFR auction, to a highly selective core group of major oil companies. Each of these options is discussed in detail below.

- **Open Forum.** It can be argued that a truly democratic approach to operating the SFR would be to open the bidding for supply to all financially capable applicants. This approach was tried with the Federal Crude Oil Reserve with disastrous results. The winner of the initial purchase bid turned out to be a non-industry party who was not

capable of performing under the terms of the contract upon winning the bid. This caused confusion, and became an embarrassing waste of time and money. Since the recommended solution for the California SFR is a “time swap” mechanism rather than an outright sale of product, (see “Operating Mechanism below), the system will require a high degree of familiarity with contractual and operational issues, such as scheduling pipelines and vessels, product quality details, etc. There will be an obligation incumbent upon any successful bidder to physically perform the contracts on both the inventory drawdown side and the product replacement side. Product will move into and out of the SFR on a contractually binding schedule. This will require a measure of professional expertise with the California supply and distribution system. Financial ability alone will not suffice to qualify an applicant to participate in the auction process.

- **Refiners Only.** Another theory advanced has been that only California refiners should be allowed to draw product from the reserve. Since price spikes are primarily caused by unscheduled events in a refinery, such as fires, explosions, unit downtime, etc. it could be argued that it is the refiners alone who should avail themselves of the product held in reserve by the State. If not limited to the particular refiner suffering the problem, then the field of auction participants should at least be narrowed down to the Refining class of trade. On the other side of this argument stands the widely acknowledged fact that a price spike caused by a supply interruption at a particular refinery impacts the statewide gasoline market, to some degree. The laws of ‘force majeure’ do not relieve a commodity supplier from delivery obligations under contract, so long as alternative supplies of that commodity are available, at some price, in the market. So too, a refinery suffering an unscheduled event that causes production curtailment and a price spike remains bound to cover his contract obligations so long as alternative supplies can be purchased or acquired through trade. That refiner, and the refining class of trade as a whole, should have the right to bid for product from the SFR, but it is not an exclusive right any more than California petroleum products are an exclusive market. Business Interruption Insurance is available to the manufacturing sector of any industry.
  
- **Qualified Stakeholders.** The balanced approach is to invite Industry professionals to participate, subject to predefined financial and performance criteria. Under this scheme all market sectors in California would be allowed to compete for product released from the SFR in volume increments consistent with their operational needs and credit limits. It may be necessary to install volume limits for individual companies in order to prevent too much of the SFR falling into too few hands, thereby creating a market control situation. A concerted effort must be made to ensure that qualified Independents have access to the SFR system.

## 8.4 Effect of Mobilizing Reserve Volumes

When the creation of the Northeast Heating Oil Reserve was being discussed, there was speculation that inventory managers would take the government's inventories into account when planning their inventories<sup>39</sup>. The theory was that creating a reserve could lead to lower inventories because the government would be there as a backstop. Similarly, during the Stakeholder meetings, several companies suggested that a fuel reserve could reduce commercial inventories.

In the course of the Stakeholder Meetings conducted for this study, a number of companies who are participants in the Northeast Heating Oil Reserve were interviewed. None of them thought that the existence of the Reserve impacted commercial inventory planning practices. However, the Northeast Reserve has only been in existence since the fall of 2000 and seemed to be a non-factor in the heating oil market after it was filled.

Given that the workable inventory range for gasoline at the refineries is only 8 million barrels (see Figure 4.1), which equates to a mere 8 days of production, it is clear that the primary consideration in setting inventory targets are operational. This is borne out by information received during the Stakeholder Meetings, in which refiners without exception reported that their operational considerations are paramount, with inventories resulting from fluctuations in demand and production that are largely unplanned.

The presence of a reserve can be a concern however to importers, who may be reluctant to commit to a cargo that would arrive 6 to 8 weeks after the onset of a price spike if volumes from a reserve are overhanging the market. To avoid these concerns, criteria can be formulated for release mechanisms:

- Release mechanisms must be clearly formulated and strictly applied.
- Trigger prices must be set high enough above prevailing levels so that imports would start to flow well before reserve volumes would be released.
- Access to the reserve must be open to all classes of regular suppliers and distributors of gasoline and components, with an option to borrow and repay in kind (time swap).

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<sup>39</sup> Statement of Neal L. Wolkoff, Executive VP, NYMEX before the US House of Representatives Committee on Commerce, Subcommittee on Energy and Power, October 19, 2000

Although some “gaming” of the release rules can be expected, it should be possible to design release mechanisms such that economics will drive inventory managers to control their inventories without regard to an eventual SFR.

## 8.5 Operating Mechanisms

After evaluating several event driven trigger mechanisms, including those whereby a price spike of “x” cpg in the spot market sustained over a “y” number of days, and is caused by an identifiable event, would trigger a time-swap auction of volumes from the SFR, the proposal is to operate the reserve volumes as a base volume for time-swaps. This trigger mechanism has distinct advantages over event driven triggers, which have the problem that hurdle levels can be set either too low (preventing normal market re-supply), or too high (requiring real economic damage to occur first). The time-swap operation also answers best to the requirements formulated in AB 2076:

“The commission shall evaluate a mechanism to release fuel from the reserve that permits any customer to contract at any time for delivery of fuel from the reserve in exchange for an equal amount of fuel that meets California specification and is produced from a source outside California that the customer agrees to deliver back to the reserve within a time period to be established by the commission, but no longer than six weeks.”<sup>40</sup>

The current proposal therefore is to create a mechanism for daily auctions, preferably in a fully transparent format, i.e., on an electronic exchange, whereby a pre-qualified participant can bid on a fee to pay for prompt lifting with redelivery within 6 weeks.

To prevent an early stock-out, the quantities that can be auctioned off on a daily basis must be limited to a prorated portion of the reserve. For instance, a workable solution may be to limit the amount of gasoline and blending components to be auctioned off for prompt lifting with redelivery 6 weeks later, to 50 TBD. Then, because there are 30 working days with auctions in the intervening period, on average 1.5 million barrels will always be on the water, with a remaining reserve of 1 million barrels in storage.

A volume of 50 TBD daily is relevant to the predicted shortfall, but would not allow all California imports to be hedged through forward swaps using the reserve volumes. Moreover, a limit of 50 TBD will not allow an importer to cover a full cargo of up to 300,000 bbl in one transaction.

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<sup>40</sup> California Assembly Bill 2076, Chapter 8.2, Section 25720, para (4) (c)

However, not all imports need to be covered through forward transactions in order for the material to make its way to California. For instance, the major refiners currently bring significant volumes to the State from within their global refining systems, and will average out gains and losses over the long term.

By leaving the market slightly short with regard to the forward time-swap options, it will limit the use of the facility to those deals that otherwise would not have been possible because of the risk, and will enable the State to collect a reasonable fee for the risk elimination.

## **8.6 Fees**

Based on comparable costs for hedging cargoes of commodities for which futures can be used to hedge the price risk, it is not unreasonable to assume an average fee of 2 cpg for eliminating a 6-week price risk. At this rate, and assuming 250 trading days with an average of 50 TBD in volumes, the gross revenues for the State from the reserve's operation as a bank for forwards time-swaps will be approximately \$10 million per year.

## **8.7 Reserve Management and Oversight**

There is currently no State agency that has the necessary experience or qualifications to perform the operational duties involved in managing a petroleum product terminal. In order to be cost effective, the function of managing the SFR will therefore have to be outsourced to private industry on a competitive bid basis. Operating the SFR means both managing its physical aspects, such as safety, quality assurance and scheduling, as well as managing the auctions, credit and collections of the State-owned inventory. For the latter, the best suited private industry entities are not the same as those who can run the terminals, and the best approach is likely to be for the State to issue separate tenders for each of the two functions.

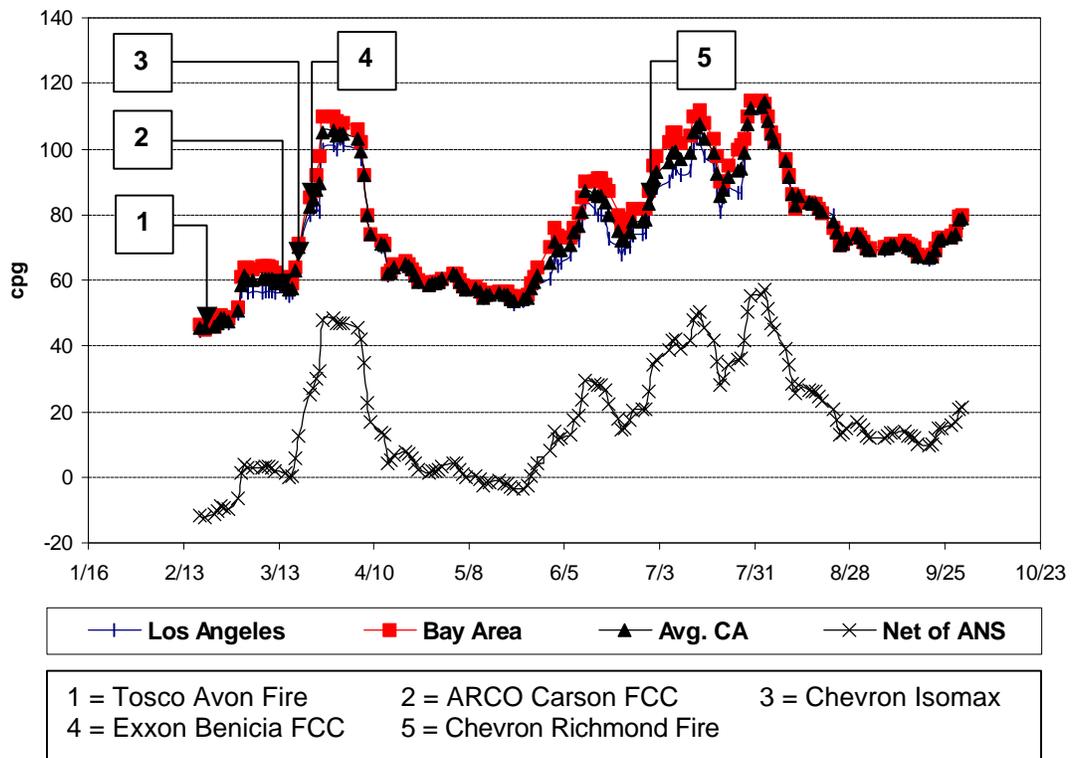
Even when the State will outsource both the physical and commercial management of the reserve, the requirement will remain to create an oversight function within a suitable State Agency, that would be empowered to supervise the reserve's operations, with authority to issue the tenders for building or converting the required terminal capacity under long-term contracts, and for the purchase of the initial fuel inventory. This Agency will further need the authority to regulate the auction process for the forward time-swaps of fuels in the reserve, to qualify participants and to oversee the usage of the fuels by the participants, with the powers to revoke trading privileges in the event a participant is delinquent on timely redelivery of borrowed volumes, or is caught using the reserve volumes for speculative purposes.

### 8.8 Effectiveness

At 2.5 million barrels, of which an estimated 2.3 million are effectively usable, the proposed reserve represents only little more than 2 days of the combined demand of gasoline supplied out of California. If the time-swap mechanism is adopted to create a forward market and stimulate imports, then the inventories at hand at any point in time may be as low as 1 million barrels only, with 1.5 million barrels on the water on its way to California.

Moreover, this volume will be divided between the two refining centers in the Bay area and the LA Basin. To evaluate the potential effectiveness of such a relatively small reserve, the events that marked the worst year in the recent history of refineries in California will be analyzed. In 1999, a series of fires and operating problems at several refineries caused two significant price spikes.

Figure 8.1 – 1999 CA Refinery Outages and Price Spikes



As can be seen in Figure 8.1, a series of refinery events, two fires and several minor outages, caused a rapid run-up in prices between February and April. Although prices had almost returned to normal by late May, they started moving upward under pressure of the summer driving season while supplies and inventories had not fully recovered from the earlier supply

disruptions. When in July another major refinery fire occurred, the market reacted with a prolonged run-up in prices.

Figure 8.2 shows to what extent supplies and inventories were affected during these events.

Figure 8.2 – 1999 CA Gasoline Inventories and Weekly Production<sup>41</sup>

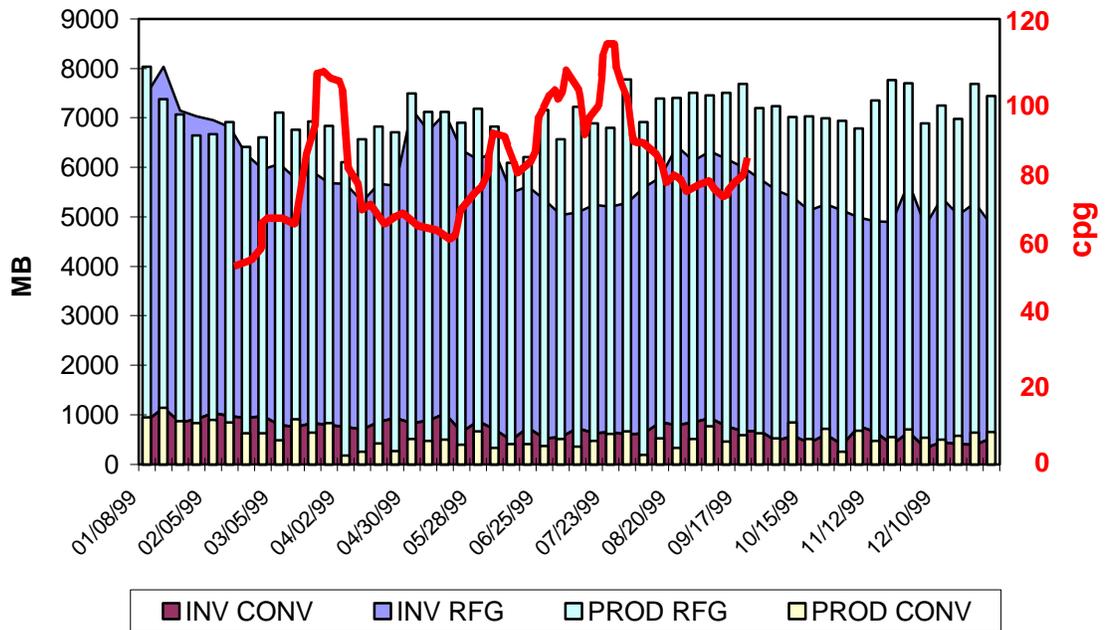


Figure 8.2 shows how the inventory swings of finished RFG and non-RFG gasoline during the 1999 price spikes was in a range of 5 to 7 million bbl, while the variations in total weekly production of RFG and conventional gasoline were from a high of around 8 million barrels per week to a low of 6 million (1140 to 850 TBD). Equally important is that the average rate of decline in inventories during the first series of events was 125 MB/week, and in the second price spike 200 MB/week.

If a reserve of 2 million barrels had been available, it would have enabled an additional supply of 200 MB/week over a period of 10 weeks, well beyond the delay within which additional imports could have been mobilized. Moreover, with the forward time-swap mechanism offering price protection to importers, cargoes would have been launched earlier. By contrast, without forward protection, an importer who would have bought a cargo in mid March 1999, at the while

<sup>41</sup> Source of Data: EIA, CEC, Weekly Fuels Watch

a steep run-up was in progress, could have lost a substantial amount of money by the time his cargo arrived in late April.

The conclusion is that a modest reserve of 2 to 3 million barrels can be effective in mitigating the effects of even severe supply outages if it is deployed in such a way that it will facilitate imports. If a reserve were to be created as an offline pool that is not part of the normal flow of imports and trades, it is likely that its deployment during the first price spike would have prevented any imports from coming in. In the absence of imports, there would have been no way to replenish either the reserve or industry inventories before the second series of events, and at the height of the summer driving season, the result might well have been even more onerous for the California gasoline consumer than was the case in 1999.

## 9 OVERALL COST/BENEFIT EVALUATION

For the purpose of this study, which is to establish the conceptual feasibility and does not yet incorporate engineering level cost estimates nor detailed information on refinery reliability, costs and benefits will only be valuated at an order of magnitude level.

### 9.1 Cost

Summarizing the results of Sections 6 and 8, and taking into account the costs of tank leases, estimated paid out lease guarantees, debt service cost for the initial fill, and the offset by fees from time-swaps, the net costs of creating and maintaining a reserve, enabling a forward market through the creation of a fuels bank, and facilitating the building of additional tankage for use by occasional importers, as proposed, are likely to be in a range from \$15 to \$20 million per year.

### 9.2 Benefits

Two primary benefits of the reserve will be evaluated, the first being the mitigation of price spikes caused by supply disruptions, and the second the improved flow of imported products needed to prevent a shortfall in supply and demand balance.

#### 9.2.1 *Mitigation of Price Spikes*

There is ample historical evidence to suggest that a major refinery outage, i.e., an unplanned event that causes the loss of the facility's entire production of gasoline for several weeks, happens in California with a frequency of somewhere between once per year and once per two years, with a small but real probability of two such events happening within a single year, as they did in 1999. This statistic implies that the probability for an individual refinery to suffer a major outage caused by an unplanned event such as a fire, explosion or major equipment failure, is of the order of magnitude of once per 10 to 20 years.

Taken over all refineries in California, minor events that cause a refinery to lose part of its capacity for periods of up to one or two weeks, appear to happen at a frequency of 2 to 4 times per year<sup>42</sup>. Even these minor outages currently can cause price spikes, but these tend to be short lived and primarily affect the spot market without translating into a corresponding increase in branded retail prices.

Table 9.1 – Sample of California Refinery Incidents 1996 - 2001

Date	Refinery	Incident	Impact
04/01/96	Shell, Martinez	FCC Hydrocracker Fire	Major
01/21/97	Tosco, Avon	Hydrocracker Fire	Minor
04/28/98	3 Refineries LA Basin	Power Failure	Minor
07/28/98	Tosco, Avon	Crude Unit Fire	Minor
02/23/99	Tosco, Avon	Crude Unit Fire	Major
03/18/99	ARCO, Carson	FCC Outage	Minor
03/25/99	Chevron, Richmond	Isomax Unit Fire	Minor
03/31/99	Exxon, Benicia	FCC Problem	Minor
07/10/99	Chevron, Richmond	Fire	Major
07/30/99	Mobil, Torrance	Fire	Minor
06/06/00	Tosco Avon	Tank Fire	Minor
04/24/01	Tosco, Wilmington	Coker Fire	Minor

The major events tend to cause a run-up in prices that generally seems to follow published price elasticity data. As shown before in Section 1.3, the 1999 multiple events that caused a production loss of 80 TBD<sup>43</sup> initially led to a 50% increase in prices and later, when the shortages had exhausted available reserves and additional minor events occurred, price rose to 100% over previous levels.

In Section 1.3 above it was shown how a single significant outage can result in a price spike that causes gasoline consumers to collectively spend more than \$1 billion in excess of what they would have paid if a price spike had been limited to the level corresponding to incremental imports. If a chronic shortage results from an inadequate import infrastructure and commercial

<sup>42</sup> Based on information from Stakeholder Surveys – Not all refiners provided information

<sup>43</sup> ARB data published July 15, 1999, relating to approval of temporary variance to sell non-conforming gasoline

barriers such as the lack of a futures market, then a prices will remain over sustained periods at levels that are substantially of those that can be expected in a well supplied market.

Figure 9.1 – CA Refining and Branded Retail Margins<sup>44</sup>

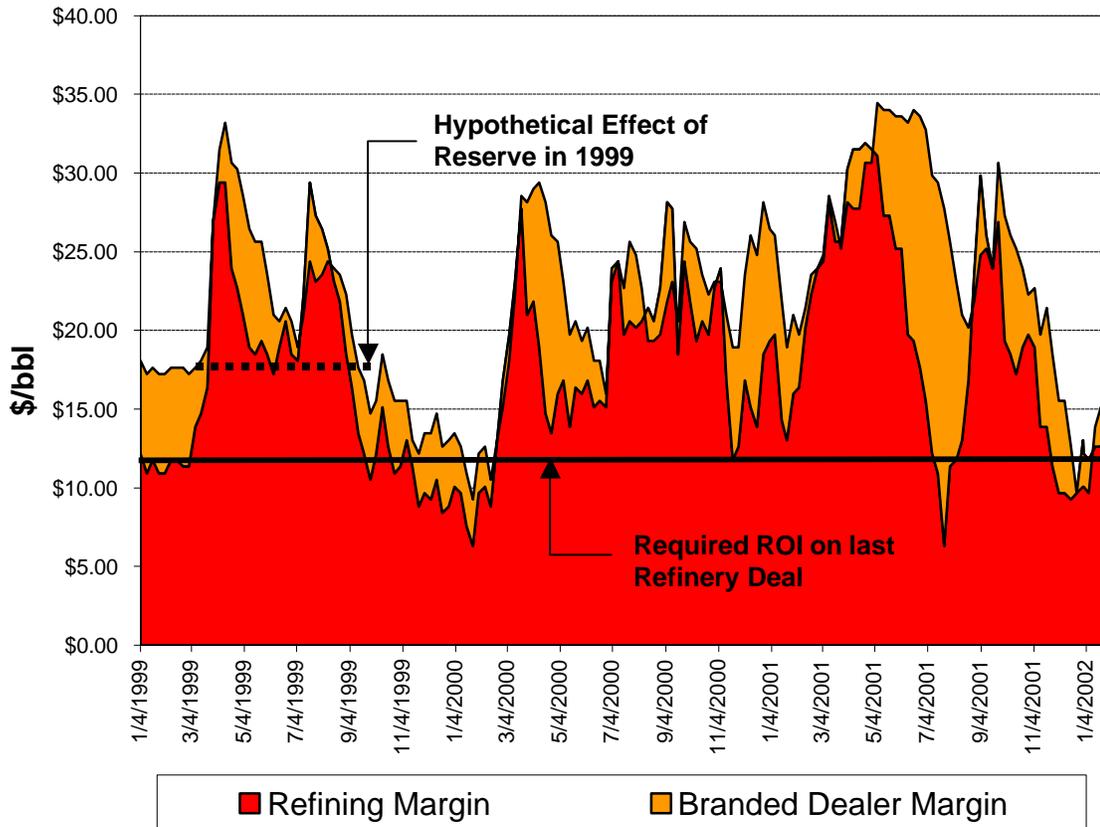


Figure 9.1 shows the estimated refining and branded retail margins in the California gasoline market over the period 1999 through present, derived at after backing out federal, state and local taxes from retail gasoline prices, and subtracting estimated crude oil cost. What is immediately clear from this graph is that with a few exceptions around the brief winter season, refining and branded retail margins have been significantly higher than the level that was published by a refiner as needed for investment recovery on the most recent California refinery acquisition<sup>45</sup>. Over this 3-year period, the net sum of margins in excess and below this investment recovery level represent a value to the gasoline consumers of California of approximately \$3.5 billion dollars.

<sup>44</sup> Source: CEC Data

<sup>45</sup> Press conference materials Tesoro Petroleum Corporation, February 5, 2002, \$11.62 crackspread (3:2:1).

The effect of the Reserve, if it had been available in 1999 and would have promoted an early stream of imports and limited the prices to a level corresponding to high world market plus transportation, would have saved the gasoline consumers in California between \$0.5 to 1 billion dollars.

Regardless of the details in these numbers, it will be clear that the costs of chronic undersupply and price spikes caused by supply disruptions is several orders of magnitude higher than the costs of the proposed fuels reserve.

## 10 RESULTS OF MEETINGS AND WORKSHOPS

One of the primary considerations of the study was to fully involve the various stakeholders in the industry. In the early stage of the study, the objective was to collect opinions and ideas through a series of meetings with individual stakeholders, whereas at a later stage, feedback was solicited on concepts and alternatives through a workshop, open to all interested parties.

### 10.1 Survey Meetings with Industry Participants and Other Stakeholders

From late August through early October 2001, the CEC and its contractor, Stillwater Associates, met with representatives of:

- All eight gasoline-producing refiners in California. For some of these, separate meetings were held with individual operating entities, while for others, a single meeting was held with corporate staff and/or representatives of several facilities.
- Six refiners operating facilities outside California, but selling blendstocks or finished products into the California market.
- Ten major international traders who regularly import fuels and blendstocks into CA and who have representation in the State, and one major brokerage house.
- Five independent marketers of gasoline in CA.
- Four major logistic service providers, owning and operating terminal facilities and pipelines for clean petroleum products in California, two of which are subsidiaries of major oil companies.
- Stakeholders from miscellaneous backgrounds, including the State of Arizona, an industry association, two publications, and the Southern California Port Authorities.

A separate confidential report was prepared by the CEC and its consultant to document the individual discussions held with the selected stakeholders. Although supply and demand for diesel and jet fuel were discussed as well, the discussions heavily focused on the gasoline markets, and in particular jet fuel was often used in the discussions only by way of example of a well functioning, stable market. Moreover, the discussions were generally qualitative in nature, with most parties reluctant to share numbers or referring to data already available in the public domain through other reporting channels.

A summary of some of the main issues raised during the meetings by the various constituents is given below.

### 10.1.1 Strategic Reserve

The broad consensus opinion of industry participants is that the California market is not broken and does not need the fix of a Strategic Reserve. Virtually all supply-side market participants expressed a clear resentment of intrusion by the government into the private market, and thought that an intervention in the natural forces of supply and demand would be detrimental to the long-term development of new sources.

Despite this initial aversion, most survey participants freely contributed constructive ideas once it was clear that the study will evaluate a broad range of alternatives, including some that might improve market liquidity as a whole, or solutions whereby the government's role might be limited to that of a facilitator of private industry efforts. The most frequently heard contributions are summarized below.

- **Location.** Although a few participants favored locations downstream in the distribution system, the more commonly held view was that the Strategic Reserve, if it were to be created, should:
  - a) Be in more than one location, with as a minimum separate coverage for the Northern and Southern California markets;
  - b) Be directly tied into the refinery supply and distribution system, i.e., at the head of the Kinder Morgan pipeline networks; and
  - c) Have access to deep water in order to be able to receive direct imports in order to be replenished from outside sources after a supply interruption, and to improve supply options in general.

The locations that meet these criteria are Concord in the Bay Area, Watson and Carson in the LA Basin, and to a lesser extent (because it lacks direct deep water access), Colton at the head of the Southern and Eastern pipeline systems. The industry insights are born out by this Study's analysis of location options and logistics requirements in Section 2 above.

- **Tankage and Inventory Options.** All participants, without exception, reported a shortage of tank capacity. For operational reasons, most refiners would not be able to increase on-site inventories in existing tankage, even when compensated

through special incentives for the higher costs of working capital and other operating and marketing costs associated with larger inventories. Traders and importers complained about their inability to find storage to land products. Given the shortage of tankage in the main distribution centers, the overwhelming consensus of the participants was that if an SR were to be created, it should not use existing tankage. This industry opinion confirms the results of Section 4 and 6 above.

- **Release Mechanisms.** None of the participants had a specific proposal for release mechanisms for eventual inventories held in the reserve. However, several stakeholders warned that whatever release mechanisms were chosen, they had to be “fair”, and “clear”. Concerns were voiced that if threshold price levels for release were set too low, the existence of a reserve would prevent the influx of additional supplies, and could cause an early stampede on the reserve by anybody with empty storage space who could then hoard the supplies until a delayed price spike occurred. Most participants stressed that a reserve should only be released to prevent real stock-outs at the pump, when prices had risen already sufficiently to ensure additional supplies from higher cost sources.
- **Quality Aspects.** With the different vapor pressure requirements for gasoline in summer and winter, and because of other quality and performance parameters for gasoline that are affected by the time over which it is stored, it will be necessary to turn over the reserve at least twice per year. This is one of the reasons why most participants favored locations within the current distribution system, so that the reserve effectively would be a bulge in the pipeline that could see continuous throughput if required.

### *10.1.2 Barriers to Entry into the California Gasoline Markets*

With the exception of some of the major refiners and the refiner-owned logistic service providers, all industry participants complained about barriers that currently prevent the influx of products from outside the State. Since the Bay Area is currently a net exporter of products while the LA Basin is short, these problems are more relevant for the Southern California market than for the north. The major concerns can be summarized as follows.

- **Lack of CARB Spec Fuels outside CA.** The single most important difficulty mentioned by current or potential importers and out-of-state suppliers are the unique quality requirements for California gasoline and diesel. This problem is

going to be aggravated by the introduction of CARB Phase III. Of the five out-of-state suppliers that were interviewed, only one claimed to be capable of producing CARBOB for Phase III. None of the others thought that the investments required to comply with Phase III would be justified given the incidental nature of export shipments to California, and the increasing opportunity to realize premium values for higher quality fuels in other markets. Moreover, few would be able to avoid contamination with MTBE above the *de minimis* requirements for MTBE post Phase III, given the nature of the storage and the costs of draining and cleaning tanks and ships for incidental shipments.

An additional complication when bringing in finished gasoline is that certain quality requirements, notably low sulfur levels, require analytical tools that are rarely available in surveyor's laboratories outside California. Material certified in a foreign port as in compliance with the specifications, may fail a retest on arrival resulting in significant financial risk to the importer.

- **Infrastructure.** All potential suppliers of out-of-state gasoline or blending components, as well as some of the major refiners with limited on-site tankage, mentioned lack of adequate infrastructure as a major obstacle to bringing in cargoes and efficiently distributing products to meet market shortages. The providers of commercial services in this area all complained of permitting barriers that prevent investment in facilities despite a viable demand. Common themes were:
  - a) There is an acute shortage of bulk liquid storage space in the ports of Los Angeles and Long Beach, which is aggravated by current policies of the Port Authorities favoring other land uses such as container and car terminals over bulk liquid storage.
  - b) Terminal facilities owned by refiners which in the past provided third party commercial services now have ceased to provide such services under the short term contracts that typically fit the needs of occasional importers.
  - c) Commercial pipeline systems are approaching capacity, especially in the gathering systems.
  - d) Projects to increase infrastructure capacity, such as additional storage or increasing pipeline capacity, meet with considerable delays in the permitting

process. Increasingly, such delays are caused by well financed, nationally operating interest groups. Delays of up to three years were mentioned.

- e) Several new legislative initiatives currently in development threaten to make this situation even worse. Of particular concern is the recently adopted Regulation 1178 of the South Coast Air Quality Management District, which will require installation of domed roofs over all open floating roof storage tanks, and the Marine Oil Terminal Environmental Review Process (MOTERP) proposed by the State Lands Commission. Both initiatives will result not only in very significant cost increases, but require key assets such as storage tanks and docks to be out of service for prolonged periods. These comments were the reason that this Study was expanded to include regulatory developments in Section 5.

The shortage in storage capacity, and the breakdown of normal supply and demand mechanisms in the storage market because of permitting delays for new projects were compared by several participants to the situation in the power industry, where years of lagging investments contributed to the power crisis.

- **Unocal Patent.** Most potential importers expressed a concern that even when finished CARB spec products were to be available outside California, they would be reluctant to attempt importing the finished product because of the risk of infringement of the Unocal patent and the associated punitive penalties. For occasional importers, licensing fees would add a prohibitive cost to an already risky trade.

Also mentioned was that the Unocal patent puts a further strain on the already scarce tankage. Blending around the patent leaves only very narrow margins, and refiners typically now need more time to prepare an on-spec blend whereas previously, final blends were prepared just-in-time before scheduled pipeline dispatch. This requires more tank space, while off-spec or near-spec batches resulting from an incomplete blending operation might take a longer time to blend off.

One participant mentioned that a patent recently awarded to Snamprogetti of Italy on blends of isooctanol and ethanol may add similar difficulties post CARB Phase III implementation, and aggravate the blending tankage situation even further.

- **Difficulties of Blending Finished Products.** With finished gasoline meeting CARB specs hard to find outside the state, importers resort to bringing in blending components. The possibility to do so is limited by a number of factors.
  - a) As stated above, the Unocal patent presents a significant risk that only a refiner with alternative resources and multiple blending options can afford to take.
  - b) Certification of the final blended product requires in-depth knowledge of complex administrative procedures.
  - c) The lack of adequate infrastructure makes it difficult for occasional importers to find cost effective blending and storage facilities.

As a result of these restrictions, traders bringing in blending components will sell such cargoes to the major refiners, who will produce the finished gasoline.

- **Lack of a liquid Futures Market.** All participants, without exception, reported the lack of liquidity in the forward market for gasoline as an impediment to imports. The inability to negotiate a price in advance for when imported product arrives, exposes the importer to considerable price risk. To produce a cargo of CARBOB, a producer typically requires two weeks lead time to schedule blending components and tankage within the refinery. Typically, this is also the time required to find shipping space. Sailing times from the closest out-of-state sources (Caribbean, US Gulf Coast and Eastern Canada Seashore) range between two and three weeks. An importer would therefore need a futures market with enough liquidity for next month or two months out in order to lock in a margin.

### 10.1.3 Market Mechanisms

The California gasoline market has a layered structure, formed by four separate but interrelated markets: Retail, DTW, Rack, and Spot, which are described in detail in Section 7.1.

The feedback received from participants in the various markets stresses the spot market as the primary source of volatility in the event of supply disruptions. This is the market where pricing is “made”, and as such would be where a reserve would have to intervene if it is to be successful in reducing volatility. Participants confirmed that the spot market can move as much as 5 cpg on one or two trades, and instances were

quoted in which market shifts of 20 cents or more have occurred with no more than 40,000 bbl of product changing hands.

The prices in the spot market translate almost directly to the rack market, while the retail market is often sheltered against abrupt price spikes by the major refiners, who are afraid to lose market share if they increase pump prices ahead of competitors. When the retail price lags the spot price too much, rack and spot based DTW customers are sometimes caught in an “inversion”, when their purchase price exceeds the pump retail price. On the other hand, on the down slope of a temporary price spike, branded retailers often manage to hold on to margins for a while, with pump prices only coming down slowly over several weeks after the spot prices has already returned to pre-spike levels. In these periods, rack and DTW customers make up for losses incurred at the onset of the spike.

It is clear from this input that release mechanisms from an eventual reserve will have to be designed to fit the needs of the spot market.

#### *10.1.4 Futures Market*

One message that came across loud and clear from the participants is that the lack of liquidity in forward markets for California is a major impediment to imports, and a significant contributing factor to instability, since virtually all trades are done on a prompt basis.

Several participants pointed to the jet fuel market as an example of a well functioning futures market, with forward deals possible as far as 6 months or even one year into the future. In the opinion of most participants, the main reasons why the forward market for jet fuel works, whereas for gasoline it does not, are:

- **Fungibility.** Jet fuel is a readily fungible product, with only a few different specifications shared on a worldwide basis.
- **Liquidity.** Because of its fungibility and ample storage facilities, many traders and importers can participate in the jet fuel market.
- **Hedging.** Because of fixed differentials between jet fuel and heating oil based on alternative uses and transportation cost, forward trades of jet fuel can be pegged to fuel oil futures, which allows traders to hedge their risk.

- **Future Demand.** Airlines have a need to buy a certain quantity of fuel forward because they also sell a certain fraction of their capacity well into the future through advance bookings. Moreover, they like to work against fixed budgets whenever possible.

Given the fact that California gasoline is not a readily fungible product, that there are no suitable forward traded commodities against it can be hedged, and that the largest market sector, the retail market, is not well suited to forward commitment on price, creating mechanisms for a futures market will be a challenge.

Many participants however thought that if a reserve was to be created in which market participants were to be allowed to use the top half of the inventory to lift product prompt and replace it within a certain period, with a bidding process to establish a value for the use of the product over time, then this would not only establish liquidity, but also offer importers a mechanism to obtain fixed forward values for product before it is put on the water.

#### *10.1.5 Inventory Planning Practices*

Current inventory planning practices varied considerable between industry participants. For some refiners, operational considerations are the dominant factor, and those refiners generally prefer to run with relatively low inventories. Other refiners, especially those who sell a significant portion of their production into the merchant market rather than into their own branded retail, will set inventory targets according to their expectations of market trends. These refiners will run their tanks as full as operationally possible if they expect prices to go up. In any case, most refiners have very little room to play with and most dismissed the concept of creating a reserve by compensating refiners to hold more inventory as not feasible.

The way market participants interpret reported industry inventory numbers is currently undergoing some changes, according to feedback received. Whereas previously the market would begin to feel tight when PADD V inventory levels fell to 25 million barrels, currently supply begins to tighten at levels around just below 30 (these numbers include finished gasoline, as well as blendstocks and unfinished products). Since the highest reported inventories are in the range of 34 to 35 million barrels, this means that effects of blending around the Unocal patent and increases in production capacity without corresponding increases in storage, apparently do affect the buffering capability of inventory.

Most participants use public sales and inventory data as provided by API and EIA, the accuracy of which was sometimes questioned. Not all were aware that the CEC provides more detailed, State specific information.

## **10.2 Meetings with CEC Staff**

*To be completed after key presentations have been made.*

## **10.3 Workshops**

*To be completed after workshops are held.*

## 11 CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this study, both in qualitative and quantitative terms, a number of conclusions and recommendations are formulated below. In addition, a long-term outlook will be formulated for a scenario in which no pro-active measures are adopted, and compared with the expected long-term results of the proposed measures.

### 11.1 Conclusions

The major findings of the study are listed below in a sequence that is in part causal, whereby increasing shortfalls, market insularity and infrastructure deficiencies combine to produce partially dysfunctional and unstable markets, in particular for gasoline, which result in significant damage to the State's economy.

#### 11.1.1 *Increasing Shortfall*

California's refineries have not been able to keep up with demand growth over recent years and California has become dependent on imports for all categories of petroleum products. Most of the growth in import requirements has been satisfied from foreign sources, because refining capacity and transportation options from within the US are also constrained. The outlook is that in-state capacity additions will be increasingly difficult to realize because of permitting restrictions. The chronic shortfall has led to market instability and increasing vulnerability to unplanned supply disruptions. The phase-out of MTBE as currently foreseen by year-end 2002 will increase the need for imports beyond the current infrastructure capabilities.

#### 11.1.2 *Market Insularity*

The California gasoline market suffers from insularity caused by its unique specifications, a subsequent lack of liquidity and inability to lock in future pricing, and impediments to market entry by outside sources. These factors contribute significantly to price volatility, in addition to the supply interruptions identified as a cause of price spikes in the legislation that led to this study.

#### 11.1.3 *Inadequate Infrastructure*

California's infrastructure for petroleum products, comprising of pipelines, terminals and dock facilities, is currently already constrained and has insufficient capacity to handle and anticipated incremental demand. Capacity additions are hampered by

lengthy and costly permitting procedures, and by policies practiced by the ports that favor other land uses over bulk liquid storage. Import terminals are predominantly owned or leased under long-term contracts by the refiners, and access to markets has become increasingly difficult for traders and importers whose business interest are short-term in nature.

#### *11.1.4 Restrictive Patents*

The Unocal patents are a significant additional burden on California's ability to meet growing demands for transportation fuels while improving air quality. The licensing fees and punitive damages are such that incidental importers will not dare to attempt to blend finished gasoline, while refineries who blend outside the patent's envelope lose capacity by diverting products from the gasoline pool and in doing so actually increase evaporative emissions.

#### *11.1.5 Limited Classes of Supply*

There is no indication of unlawful market practices and competitive forces do still result in deep price cuts at times of temporary oversupply in the market. However, for gasoline in particular, supply of finished product is limited to the in-state refiners, and despite the fact that the market has become import dependent, with the incremental import barrel determining the price of the market as a whole, neither independent importers upstream of the refiners nor independent marketers of finished product downstream of the refiners currently have the means to bypass the refinery controlled infrastructure.

#### *11.1.6 Economic Impact*

The increasing import dependency of California requires incremental supplies from remote foreign sources that meet unique specifications and carry significant manufacturing and transportation cost. These supplies will set the market price, and the premium that California will have to pay for its import dependency is likely to be in the range of 20 to 30 cpg. This represents a value of \$3 to \$4.5 billion per year, but this is not a number that will be affected by the creation of a reserve. The economic impact of a price spike of 50 to 60 cpg over a period of 4 to 6 weeks is \$0.6 to \$1 billion. The effect of these incremental expenditures on the State's economy is somewhat similar to the legacy of the higher electricity prices caused by the power crisis: a significant portion of the gross impact will flow to out-of-state corporations or foreign entities at the expense of discretionary spending by California households and businesses.

## **11.2 Recommendations**

*Will be formulated after the workshop.*

